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THE
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Vol. XXXIII ST. LOUIS, APRIL, 1923 No. 4

ORIGINAL COMMUNICATIONS.

(Original Communications are received with the understanding that they are contributed exclusively to THE LARYNGOSCOPE.)

THE RADICAL OPERATION IN CHRONIC SUPPURATIVE OTITIS MEDIA. A CONSIDERATION OF THE TECHNIQUE. THE USE OF THE PRIMARY SKIN GRAFT AND THE RESULTS OF THE OPERATION WITH PARTICULAR REFERENCE TO THE FUNCTION OF THE ORGAN.

DR. EDWARD B. DENCH, New York City.

It may seem rather strange to present a paper on what seems tc be a well known subject to the International Otological Congress. The radical operation for the cure of chronic middle ear suppuration has become an established procedure in otological surgery and many of those present may deem any further contribution to the subject unnecessary. Unfortunately in the United States, and particularly in New York, where the procedure is performed with increasing frequency, there seem to be many men who believe that the operation should be employed only in cases where the middle ear lesion is actually threatening life, or where the function of the organ has been so ablated by disease as to render any further danger to the hearing impossible. Opinions also seem to vary as to the success of the procedure in obtaining a dry ear. It is for these reasons that I am presenting this paper.

From a rather large experience with the radical operation, it seems to me that the real question as to whether we obtain a dry ear or not is very largely one of technique on the part of the oper-

*Read before 10th International Otological Congress, Paris, July 19-22, 1923.

ator. It is for this reason that I wish to enter somewhat into the technique of the operation. The same remark applies to the effect of the operation upon the function of the organ. It is not uncommon for the general physician to object that if the patient is subjected to this procedure, that the ear must necessarily become absolutely deaf. Another objection to the operation is that it is very dangerous to life, in spite of the fact that the condition for which we are operating is one of the utmost gravity. The danger of accidental injury to the facial nerve is another objection raised against the more uniform adoption of this procedure. It is for these reasons that I am bringing this subject before this Society.

As to technique, much can be learned prior to the operation by a careful examination of the ear with speculum and by X-ray plates. The X-ray plates will tell us whether we have a large pneumatic mastoid to deal with or whether, as is usually the case, we have a small and often sclerotic apophysis. The position of the sinus will also be determined in many instances by the X-ray plate. The speculum examination is of value in that it teaches us much about the depth of the hypo-tympanic space and the posterior tympanic space, the condition of the eustachian tube, and the amount of destruction of the outer wall of the tympanic vault. The location of the incision will depend somewhat upon the information obtained by these means. Ordinarily the incision should extend from the tip of the mastoid upward, following the line of insertion of the auricle and about a half an inch behind this line. If the mastoid is large and pneumatic, however, the incision should begin below the tip, and should extend behind the ear far enough to permit exenteration of all the cells, and yet have the posterior margin of the incision rest upon firm bone. If this is done, little or no deformity will result. In the same way, if the tip cells are well developed and demand removal, the incision should be carried far enough below the tip to permit of exenteration. If the mastoid is sclerotic, I never carry the incision below the tip of the mastoid and never clear the tip of the mastoid of the attachment of the sterno-mastoid muscle, as this procedure opens up the planes of the neck to possible infection and is unnecessary unless the tip is to be removed. The upper portion of the incision should divide no fibers to the temporal muscle if this can be avoided. Of course, if the zygomatic cells are extensively involved, it will be necessary to carry the incision over the insertion of the auricle and in some cases it will be necessary to divide the muscle. It is important, however, to incise only the soft parts down to the muscle and then elevate the temporal muscle

without cutting it. In other words, the incision should be only large enough to permit complete exenteration. In the formation of the cavity, it should be remembered that the more complete this exenteration, the more certain is the result to be satisfactory. The facial ridge should be taken down as low as possible and the floor of the canal should be lowered. The hypo-tympanic space must be absolutely obliterated and the posterior space as well, no matter how deep. The major portion of the overhanging wall can be taken away with the gouge; to complete the removal the sharp curette, shaving carefully away the overhanging bone hiding either the hypo-tympanic or posterior tympanic spaces, is undoubtedly the safest instrument that can be used. The curette must be very sharp and the fragments of bone removed exceedingly small. In this way, if we have a high jugular bulb, the bulb can be easily exposed without wounding it. In the same manner, the operator recognizes the firm covering of the facial nerve before the canal is entered, or if the canal is entered a thin scale of bone is removed from the outer wall, and although the canal is entered the nerve is not wounded. The eustachian tube should be thoroughly curetted and the tube and the canal lodging the tensor-tympani muscle should be thrown into one space. Certain anomalous positions of the facial nerve should be remembered; that is, the facial may be more oblique than normal; that is, it may be more superficial on the level of the floor of the canal than is ordinarily the case. Careful lowering of the ridge will ordinarily prevent wounding of the nerve. Occasionally the nerve makes a sharp bend forward beneath the floor of the canal, and in one or two instances I have exposed the nerve in this region. The jugular bulb may be occasionally wounded, and this has occurred in three instances in the series of cases reported. In one instance, it was wounded in the posterior tympanic space, and in the other two in the hypo-tympanic space. In none of these cases did any untoward symptoms follow.

The tip of the mastoid should be removed only in those cases where it is diseased. If it is pneumatic it must be taken away, as gross appearances do not enable us to determine where diseased structure ends and normal structure begins. If the tip is simply diploic, there is no advantage in removing it completely. This I have demonstrated in a very large number of cases.

Having given attention to details in forming the cavity, the next most important point is the enlargement of the external auditory meatus. I have seen a number of cases in which the operator has formed an excellent radical cavity, and yet the operation has been

a failure because the meatus was not made large enough. The size of the external auditory meatus must bear a certain relation to the size of the cavity. The cavity must be aerated properly if it is to remain dry, and this is impossible if the cavity is large and the meatus small. It may be said, as a general rule, that the larger the meatus, the more satisfactory will be the result, and in many of the operations I have erred on the side of making the meatus too large and causing what might be called a slight deformity, rather than to run the risk of making the meatus too small and have the result of the operation unsatisfactory. I know in one case where the patient had had a dozen previous operations, including an exploration for brain abscess, and yet a foul purulent discharge was still present and he complained of distressing headaches. When I operated on him I found that an excellent radical cavity had been formed, but that the meatus was not large enough. A correction of this fault and the use of a primary skin graft caused a complete cure.

A few words may not be amiss about the method of enlarging the external auditory meatus. My own procedure consists in carrying a blunt bistoury into the canal and incising at first downward, dividing all the tissues of the meatus. The knife is then swept backward and upward into the concha for a variable distance, depending upon the size of meatus demanded. Cartilage and fibrous tissue are then removed from the conchal flap, and this flap is bent backward and upward upon itself and stitched into position with ten-day chromic gut. This procedure is really a slight modification of the one advised by Ballance, and has been the most satisfactory of all in my hands.

The next point in technique which I wish to consider, and for which I claim a certain amount of originality, is the systematic use of the primary skin graft. While many operators have used skin grafts in radical cavities, Sir Charles Ballance was the first to use these grafts in anything like a scientific and intelligent manner. Mr. Ballance, however, especially in his earlier operations, did most of his grafting secondarily. Through the courtesy of Mr. Ballance I was enabled in 1900 to follow his technique, and to see the ultimate results obtained. I was so convinced of the value of the method, that I then began to use the primary skin graft at the time of the operation. As I understand it, Mr. Ballance had done this in certain cases, but did not make it a regular procedure. From 1900 I have used the primary graft in every case, excepting where it has been necessary to perform the operation during an acute exacerbation of the chronic inflammation. The graft has been used, irre-

spective of exposure of sinus or dura. It has not been used where the sinus or dura has been wounded, excepting in two cases where the bulb was wounded by a minute opening. In these cases the patient made an uninterrupted recovery. If the labyrinth has been opened, the primary graft should not be employed, although in one instance of localized labyrinthitis the entire cavity was grafted, excepting a small labyrinthine area which was protected by an iodoform gauze packing. In this case no intracranial symptoms followed.

To use the primary graft as large a graft as possible should be employed, and the entire cavity should be completely lined with the graft. The graft is made to apply itself to the wall of the cavity by removing air beneath, by means of a pipette, as recommended first by Ballance. The epitelial insert is then held in place by pledgets of sterile cotton. Great care is taken that the graft is forced down well into the mouth of the eustachian tube, and then is lapped well over the anterior wall of the canal. In other words, it is essential that the mouth of the tube be covered by the graft. The success of the primary graft depends upon the accuracy with which the graft is applied to each and every wall of the cavity. After the bony cavity has been lined the redundant portion of the graft is bent forward, and the auricle replaced. The redundant portion is then drawn through the enlarged meatus, and is held in position by a packing of sterile gauze, after which the auricle is replaced and held in position by Michel clips, or silk worm gut sutures, according to the fancy of the operator. This drawing of the graft through the meatus, so as to cover the cut edges of the meatus and also the raw edges of the anterior flap, is of the utmost importance. Where the graft is not large enough to do this, two grafts are employed, and sometimes three, but it is always essential at the end of the procedure to have the graft large enough to draw through the meatus, and then packed back firmly against the cut margins of the meatus and the raw surface, which forms the posterior part of the cavity. Mr. Ballance accomplishes this same purpose by a slightly different method, but the plan that I recommend here has been more satisfactory in my hands.

The plan of operation outlined has been the one that I have followed in most of the cases reported. As the report shows, some cases have been grafted secondarily. These were cases where either the sinus or dura were wounded, or there were some intracranial symptoms, or where the condition of the parts was so septic as to render primary grafting inadvisable. When the secondary grafting

has been employed, we usually perform the procedure about ten days to two weeks after the primary operation. In other words, as soon as the cavity has sufficiently granulated to warrant the supposition that the graft will take. In a few cases no grafts were used. These were some of my earlier cases, and some done by my assistants.

The results obtained are appended. I have divided the cases into two classes, cases operated upon in private practice and those operated upon in hospital practice. Unfortunately, many hospital cases disappear if a good result is obtained, and it has been impossible to follow up many of these to determine the acuteness of hearing or the permanency of the result. It must be remembered, however, that hospital cases that are not cured return regularly. Hence, many of the cases marked result unknown are undoubtedly well. Statistics regarding fatalities are, I believe, absolutely accurate.

With reference to the effect of the operation upon the hearing, the statistics I give, I think, speak for themselves. In only very few cases has the hearing been made worse, unless it was almost normal at the time of operation. I believe here that the general medical men have been guilty of grave error, in that they dissuade many patients from submitting to the operation, for the reason that they believed that the hearing would be impaired by the procedure. My own determination as to the probable effect upon the hearing is as follows: If a patient hears a moderate whisper at 20 feet and shows no evidence of disease of the preceptive apparatus, the hearing may be slightly impaired following the operation. On the other hand, if he hears the whisper only four feet or less and there is no evidence of disease of the preceptive apparatus, the hearing will probably be improved. Of course, if the patient is absolutely deaf, or the patient has a dead labyrinth, no hope can be held out for any improvement. It is a significant fact, on the other hand, that in many cases the improvement in hearing has been truly remarkable. For instance, I have had several patients on whom it was necessary to operate upon both ears. These patients are only slightly hard of hearing and are able to follow their vocations with practically no difficulty. One is a young woman at college, who has very little difficulty in following her lectures. In one of the cases, the patient was suffering from a double middle ear suppuration. Fortunately the ear in which the discharge was more profuse and in which the disease seemed to be of greater menace to life, was the one in which she heard more poorly. This ear was operated upon, and the hearing was so much improved that the patient returned a few years

later and requested that the other ear be operated upon to improve the hearing. The hearing was improved in this ear also as a result of operation. These results can be obtained if great care is taken to follow accurately the points laid down in this paper.

My notes show 480 cases operated upon and 14 deaths. Of these 480 cases, 112 occurred in private practice and my notes are rather complete. Of these 112 cases, three cases died. The cause of death in one case was pneumonia, in the second case, fibro-sarcoma of the eighth nerve and an old cerebellar abscess. This case died a year after the operation. The third case in which death occurred was due to heart failure; so that in these cases the operation had nothing to do with the fatal termination. Of the eleven deaths occurring in the 368 hospital cases, one patient died of pneumonia; one of pulmonary thrombosis two hours after the operation; one of gastric hemorrhage; two of cerebellar abscess; and one at the close of the operation apparently from the anesthetic. In this case incidentally the labyrinth was the seat of a suppurative labyrinthitis. Five cases died of meningitis, and in one of these the patient was the victim of splenic anemia, and had several positive blood cultures eight or nine months before the operation. It is possible that the lumbar puncture prior to the operation may have induced the meningitis. In only four of the 368 cases, therefore, has meningitis actually followed the operation. When we consider the gravity of the condition for which we operate, this mortality is very low.

Of the private cases, primary grafting was employed in 92 cases, secondary grafting in five. No graft was used in 13, and in two the notes do not state whether or not any graft was used. Ninety-five of the private cases have been absolutely cured, that is, the ear remained dry. In seven, there was less discharge, but the ear was not dry; in three, there was no improvement, and in four cases, the result was unknown. The hearing was improved in 65 of the private cases, remained the same in 27, is reported as worse in 8 and the result was unknown in 9. In one of these cases, the hearing was nearly perfect before operation and the patient was warned that some impairment would probably follow. This impairment is not great and the patient hears the spoken voice at 23 feet, but the hearing is not as good as it was before. In another of these cases, the patient developed an acute brain abscess, which was operated upon successfully. In a third case, the labyrinth was extirpated at the first operation on account of acute labyrinthitis, and later a radical with primary skin graft was done. This patient of course was deaf when operated upon. In two of the other cases, the hearing

was practically useless before operation, although tests after operation show that the procedure had slightly diminished the hearing, which was already poor. In the remaining three, some impairment did occur following the operation, although this was by no means severe.

Of the 368 hospital cases, the notes, I am sorry to say, are not very complete. Primary graft was employed in 235 cases, secondary graft in 34, and no graft was used in 87, and in twelve the technique is not known. Of these cases 114 are known to have dry ears; the result is unknown in 243. As stated previously, these hospital cases invariably continue to report back to the Clinic, until they are well or greatly improved. It is fair to assume, therefore, that a very large proportion of these cases are either cured or improved. The hearing was improved in 12 of the cases, and in one it remained the same, while the record of the hearing is not known in 343 cases. I am certain that in only a very small proportion of these cases, not more than 1 or 2 per cent, was the hearing made worse, because any increased impairment would have been noted by the patient, and would have constituted a cause of complaint. For this reason, although the records are incomplete, I feel certain that there was no seriously increased impairment of hearing in any of these cases.

These statistics show that the operation is as devoid of danger to life as any major surgical procedure can be. Certain other complications may occur, however, and perhaps of these a facial paralysis is the most feared. Fortunately, in the series of private cases only six have occurred. In three of these, the facial paralysis came on immediately after the operation, was only partial, and in all it cleared up perfectly. In the three others, the paralysis came on two or three days after the operation, the facial nerve functionating perfectly at the completion of the operation. In these cases the involvement of the facial was undoubtedly due to a septic neuritis, in all of the cases restoration of function was rapid and complete. Where the facial paralysis occurs immediately after the operation, the operator is naturally much disturbed, as it shows that the nerve has been injured during the procedure. A paraylsis coming on three or four days after the operation need cause no anxiety, as these cases invariably clear up perfectly. These six cases of interference with the function of the facial nerve occurred in the series of 112 cases. I have not a record of the cases of facial paralysis occurring in the 368 hospital cases, but I know the number was very small and without exception all recovered. So that with a careful operator the danger of facial paralysis, while it should always be borne in

mind, should not deter one from resorting to the radical operation, if it is demanded.

Of the private cases, there was labyrinthine involvement in seven, prior of course to the operation. In four of these cases, the labyrinth was extirpated, as the labyrinthitis was diffuse. In three, labyrinthine lesion was circumscribed and the diseased area alone was dealt with. All the cases recovered.

Before closing it may be well to say a word about the after care of these cases. While the radical operation gives us a dry ear in practically 95 per cent of our cases, this does not mean that as soon as the ear has once become dry that it needs no attention. No matter how perfectly the radical cavity may be lined with skin, desquamation will take place for a number of years after the operation. The desquamated epithelium will fill the cavity and, unless removed, may cause a reappearance of the discharge. Removal of the epithelial cast, followed by an application of 80 per cent alcohol to the wall of the cavity, will bring about epidermization. In all cases it is wise, therefore, for the patients to have the ear inspected once or twice a year to avoid this inconvenience. After the circulation in the graft becomes better, this desquamation tends to cease. Another point, which is worthy of notice, is that the hearing in quite a large proportion of these cases can be improved by the application over the region of the stapes of a disk of cotton saturated in sterile vaseline. Most of the cavities will tolerate this pledget, and the improvement in hearing is frequently marvelous. In a number of the double cases in which the operation has been performed, the patients wear disks of this character with great benefit. In cases of radical operation, if the hearing is much impaired, this method of improvement is worthy of trial. Many of these patients learn to introduce the pledget themselves, and in some instances do it much better than the surgeon.

I have tried in this paper to demonstrate that the radical operation is practically free from danger both to life and to hearing, that it removes permanently all danger of intracranial complications incident upon middle ear suppuration, and that it cures the suppuration in over 90 per cent of the cases, while the function of the organ is either improved or the same in about 90 per cent of the cases.

BLOOD TRANSFUSION FOR OTOLOGICAL DISEASES.*

DR. LESTER J. UNGER, New York City.

The enthusiasm for blood transfusion is based on the fact that the procedure has been very rapidly simplified, that the dangers have been eliminated, and that there is a greater appreciation of its therapeutic value.

The indications for transfusion are hemorrhage, diseases of the blood, toxemia, shock, debilitating conditions and infection. From the point of view of the otologist, many of these indications are not encountered as frequently as others. Nevertheless, to a certain extent, they are met with by him as well as by the internist and general surgeon.

The last indication, infection, is the one which is of special importance to the otologist. When the clinical diagnosis of bacteriama, secondary to an ear infection, has been made by the otologist, and established by the pathologist by means of a positive blood culture, the indication for transfusion, in addition to whatever surgical interference the otologist considers necessary, is quite clear. Blood transfusion in these cases maintains the proper amount of hermoglobin and the number of red blood cells. Secondly, it acts as a supporting measure to the patient, and thirdly, it overcomes the bacteriama.

One hundred and two transfusions have been performed on sixty-three cases of bacteriama. In analyzing these cases, not only the source of the bacteriama must be considered, but also the type donor from whom the blood was taken. On the first case of this series, transfusions were performed, using as a donor an ordinary, strong, healthy individual, whose blood merely was compatible with that of the patient. Of twelve cases whose sepsis originated in the mastoid, six recovered. For the later cases methods were employed for enhancing the value of the blood to be transfused. The donors were vaccinated with the organism obtained from the blood of the patient. This autogenous vaccine was injected in the usual doses, starting with one hundred million bacteria, every other day, and rapidly increasing to one billion. Seven cases (not all otological) were transfused with the blood of such donors. None of these recovered. It was found later that, although these donors had been vaccinated, they really had not been immunized, since no agglutinins could be

*Read before the Section on Otology, New York Academy of Medicine, December 8, 1921.

demonstrated in their bloods. For the third series, the donor was vaccinated in such a way that demonstrable immune bodies were developed. The phagocytic index of the donor was also greatly increased. Fourteen cases were transfused with such blood. Eight had received blood from a donor who had been immuned with the organism obtained from the blood of some other patient. Such a donor is conveniently called a heterogeneous immunized donor. Three of these cases recovered. Six had been transfused with the blood of a donor who had been immunized with the organism obtained from the patient's blood—an autogenous immunized donor. Five of these recovered.

If organisms are circulating in the blood stream of patients with sinus thrombosis, the diagnosis can usually be made twenty-four hours after taking the blood culture. That same day the transfusion should be performed, either before or after the jugular vein is ligated, depending upon the general condition of the patient. The donor who is used should be a heterogeneous immunized donor. An autogenous vaccine can be prepared immediately and immunization begun. It takes nine or ten days for a donor to be properly immunized. If it is possible to wait that long, it is advisable to do so. If it is only possible to wait five days, it is advisable to use this donor who by this time is possibly partially immunized. If between the time of the first transfusion and the fifth day, the patient is apparently worse, a second transfusion should be performed with another heterogeneous immune donor. On the ninth or tenth day, this is followed by transfusion with the autogenous immune donor.

The blood of one donor may be of more value to the patient than that of another, even though they both belong to the same isoagglutinin group. By performing phagocytic index tests it was found that donors can be divided into two groups. In one group the phagocytic index is from sixteen to eighteen, while in another it is from four to six. Attention should therefore be paid to tests which establish qualitative differences in the blood of donors. This is especially important in the treatment of bacteriama.

In selecting a donor to be immunized, one should in addition to obtaining a person whose blood is compatible with that of the patient, also select one whose phagocytic index is high. Agglutination tests against the organism found in the patient's blood should be performed to establish the fact that he has developed an immunity as a result of the inoculations.

The cases just reported were transfused by the method described by me some years ago. The mechanical principle involved in the

instrument used in this method is the establishment of two channels by means of which a record syringe is automatically connected alternately with a vein of the donor and then with one of the recipient. At the same time that the record syringe is connected with the donor for the aspiration of blood, a syringe with saline solution is connected with the recipient and vice versa. It is this immediate and continued flushing with salt solution of that channel through which blood is not passing that insures freedom from clotting. The technic is as follows: Alongside the instrument, which has been fixed to a table, the arms of the patient and the donor are placed. The tubes leading from the instrument are connected to the cannulas after the latter have been inserted through the skin into the recipient's and donor's veins. A record syringe is then inserted into the instrument, and blood is injected. Simultaneously saline solution is forced through the channel which is not being used for the aspiration or injection of blood. This procedure is continued until the desired amount is transfused. In order to prevent clotting, a stream of ether is played on the barrel of the record syringe while it is being filled with and emptied of blood. In this way only one record syringe is required, regardless of the amount transfused. This method supplies whole unmodified blood. Citrated blood transfusions are contraindicated in cases of infection. Chemical or physical alterations are brought about in the blood by the addition of sodium citrate and by its sojourn outside of the vessels. The addition of sodium citrate to blood destroys its complement content and furthermore renders it anticomplimentary. It renders it almost devoid of opsonins and interferes with the phagocytic activity of the white blood cells. It is by means of these factors that we protect ourselves against bacteria. After citrate transfusions a chill occurs in about fifty-seven per cent of the cases and febrile reactions in sixty per cent of the cases. After whole, unmodified blood transfusions, a chill occurs in only about three to five per cent of the cases, and a febrile reaction in about ten per cent of the cases. These reactions are due to changes in the blood platelets which have undergone alterations coincident with early coagulution.

For diseases, therefore, in which the transfer of blood is required as a tissue as in the various anemias, blood diseases or infections, there can be no question as to the superiority of whole, unmodified blood. In cases of hemorrhage, on the other hand, where the purpose is not so much to replace pathological with normal blood, but rather to replenish the impoverished circulation or to bring about cessation of hemorrhage, citrated blood may serve as a substitute.

BLOOD TRANSFUSION IN OTOLOGICAL DISEASES.

Dr. Harold Hays, New York City.

A subject of such great importance as this deserves more than passing attention. For some time, I have been urging Dr. Unger to present this method of transfusion before a society of otologists, because I have been convinced that the transfusion of whole blood will often bring about a result in a puzzling case which seems almost miraculous.

I am not in a position to discuss the relative merits of the various methods of blood transfusion. I have seen every method used and, where the transfusion has been performed dextrously, the results have been uniformly good. However, I feel that the simplest method is most always the best method, as the systemic reaction is less likely to be severe. And no method can be much simpler than the one explained tonight by Dr. Unger. One may take exception to this statement by recalling the simplicity with which citrated blood is given, but citrated blood is whole blood plus something else, which certainly makes it less ideal, from the theoretical point of view at least.

In what class of otological cases is blood transfusion of the greatest value? From my own personal experience, I would divide the patients into two classes; 1st, those patients who have been considerably devitalized as the result of a severe mastoid operation, and, 2nd, those patients who run an intermittent temperature after the mastoid operation which may or may not be accounted for by an infection of the sigmoid sinus.

Class 1. I have seen many patients who, having had a mastoid operation performed, often after having had their vitality sapped by an acute illness before the ear infection, are unable to regain their strength. The hemoglobin is generally 60 per cent or lower. They run a low grade temperature, between 99° and 100.6°. Their wounds do not heal quickly. The granulations are pale and flabby. Such patients will eventually get well if their systems are properly toned up, with food and rest, but the convalescence is prolonged. In such a case, the transfused blood acts as a rapid tonic and the patient regains his vitality in the course of a few days instead of in a few weeks or months. The relation of one case will illustrate. A child of three was operated upon for an acute mastoiditis on the right side, after a suppuration from both ears lasting three weeks.

Two days later the left mastoid process had to be opened up. For a few days, the child seemed better and then the temperature shot up to 105°. Blood cultures on the following days were negative. The blood count frequently showed 45,000 to 50,000 white blood cells with 90 per cent polynuclear cells. After numerous consultations, a diagnosis of broncho-pneumonia was made and the child went on into one of those protracted and prolonged convalescences so often seen in such cases. The temperature was always slightly above normal. Dr. Unger finally gave a transfusion of 400 C. C. of blood, after which the child quickly began to mend. The hemoglobin, which had been between 50 and 55 per cent, rose to 80 per cent. Within a short time she was out of bed. The mastoid wounds, which were healing very slowly, soon began to show signs of closing and, a week after the transfusion, the child was able to leave the hospital.

Class 2. Patients who run an intermittent temperature after the mastoid operation are most puzzling, particularly if the blood cultures remain sterile and there are no other positive evidences of sinus thrombosis. It is in these cases that the transfusion of blood is of the greatest value. Dr. Unger has transfused a number of such cases for me and the results have been so uniformly good that today I would hardly think of opening a sigmoid sinus, where there was a negative blood culture, without having a transfusion of blood performed first, to see if this, in itself, would not bring down the temperature. Before illustrating this point, by the citation of two interesting cases, I wish to point out that, in patients who have been operated upon for thrombosis of the sinus and in whom the temperature still continues remittent, possibly because some bacteria are still in the blood stream, there is nothing of which I know which will bring the recovery about more quickly than a transfusion of blood. I am sure Dr. Unger can tell you of any number of such cases.

But I can no better impress upon you the value of blood transfusion than to cite two cases:

Case 1. P. N., a little girl of six years, had a suppuration from both ears which necessitated a double mastoid operation. At the time of operation, both sinuses were uncapped. There was a perisinus abscess on the right side. The patient did well for ten days, when the temperature arose to over 104°. The blood culture was negative. Blood count showed 20,000 white blood cells with 85 per cent of polynuclears. Examination of the throat revealed a swelling on the left side, probably a peritonsillar abscess which eventually

emptied itself, whereupon the temperature went down to between 100° and 101°. She was discharged from the hospital. The following day the temperature rose to 104° and continued high for four days, finally rising to 105.4°. Repeated blood cultures were negative. The temperature then went down to normal again, but finally crept up to 106.4°. Both Dr. Bass, the pediatrician, and I were puzzled. I did not feel warranted in opening up the sinuses because there was absolutely no evidence, other than the temperature, to indicate that either sinus was involved. At Dr. Bass's suggestion, the child was again brought to the hospital for a blood transfusion from the father. The temperature at this time was 102°. The night of the transfusion it rose to 106.4°, and the following day went down to normal, where it remained. The child made a rapid and permanent recovery.

Case 2. At the time that this child was in the hospital, I was taking care of a most puzzling mastoid case. Miss F. M., age 39, had developed an acute mastoiditis which offered no great difficulties at the time of operation. The sinus was not exposed. At the end of the tenth day, she left the hospital, apparently well. A few days later, her family physician informed me that she was running a low, irregular temperature. Suddenly she developed a temperature of 104° with a distinct chill. For the following two days, the temperature was normal and then it again rose to 104°, accompanied by a chill. This same performance occurred a number of times. The blood cultures were always negative. The blood count was 6,000 white blood cells with 60 per cent polynuclears. Two internists examined her carefully for a possible typhoid fever or malaria. As she complained of pain below the mastoid wound, I thought it best to open the wound. It was found to be clean. Between the rises of temperature, the patient felt well enough to be out of bed and to do some of her clerical work. There was never any definite headache and her general condition did not seem to suffer. Eye examinations, nasal examinations, gynecological examinations were all negative. There seemed to be nothing to do other than to watch for some definite symptoms of sinus involvement. The case seemed to be one classified under the heading of "protein fever," whatever that may mean. The patient was in the hospital at the time that Dr. Unger did the transfusion on the little girl whose case I have just described. I suggested a transfusion from her twin brother. About 500 C. C. of blood were given her. The following day the temperature rose to 103°, then returned to normal, where it remained until she was discharged from the

hospital a week later. There has never been the slightest evidence of trouble since then.

These two cases indicate very clearly that blood transfusions should always be given in any cases in which there is an unexplained temperature after an operation upon the mastoid process. If the transfusion does no more than tone up the general system of the patient, so that he is able to withstand a further operation better, it will have accomplished a great deal. Mention has been made that transfusion of blood in cases of pronounced septicemia of otitis origin, will tend to clear up the blood, particularly in those cases in which the donor has made his own blood resistant to the special infecting organism in the patient to be transfused. But the tonal effect of new blood will be a great deal. I have in mind one case, a child who had a thrombosis of the sigmoid sinus on the right side and who was developing metabolic abscesses in various parts of the body. The transfusion of blood gave his system that renewed resistance which was so necessary.

To sum up, I should like to emphasize the following points: 1. The Unger method of blood transfusion is exceedingly simple and is therefore to be preferred to other methods. 2. It has the advantage over the citrate method in that no foreign material is added to the blood. 3. Transfusions of blood are of the utmost value in all cases of operated mastoiditis, (a) cases in which the patient is either so debilitated that his systemic condition must be immediately improved, or (b) cases in which there is an indefinite, high temperature which cannot be associated with any definite pathological condition.

2178 Broadway.

CASE OF TUMOR OF THE CEREBELLUM THAT GAVE NEGATIVE RESULTS TO TESTS OF LABYRINTH AND LABYRINTHINE TRACT.*

Dr. Benjamin Rosenbluth, New York City.

It often happens that the clinician cannot connote the findings of the laboratory, or other special means of research, with his impressions and clinical examination. The fiat of the special examination or laboratory work is negative or positive, according to the result of the work done and seldom has the equation of average of error, which the deductive results of observation teach us are necessary as a check to all scientific work. To be guided entirely by the special report, no matter from what source or authority, negates the experience and judgment of the clinician, which is not only of his own gathering, but is also built up on the sum total of the experience of his predecessors in a given field of work, and of medicine in general. The problem presented by the subjoined case, put us in this dilemma, of choosing between the clinical and the special examination.

The symptomatology and clinical findings were quite typical and direct. The results of the special research by means of the rotation and caloric tests, which are supposed to be conclusive, were so contradictory, that we hardly had confidence in our observation of what we saw. Fortunately, we were able to justify our rejection of the special findings by a post mortem examination of the intra-cranial contents.

The patient, I. F., No. 10481, was a boy ten years of age, with an unimportant family and past history. Three weeks before admittance to the hospital, he was suddenly seized with severe headaches, which became much worse during the ensuing week, during which time he became mentally obtunded. The week after, vomiting set in after every meal, and he began to walk unsteadily. The boy was admitted to the Beth Israel Hospital, in the service of Dr. J. Reinthaler, on April 10, 1922. The physical examination records the little patient as a pale, flabby, blonde child, with high forehead, showing remains of craniotabes with rather short and narrow palpebral fissures, eyes somewhat closely set, and in appearance reminiscent of Mongolian idiocy. His frame showed remains of rickets in childhood. The chest and abdominal contents showed no abnormality. His mouth was in fairly good condition.

*Read before the New York Academy of Medicine, Section on Otology, May 12, 1922.

There were some small cervical glands palpable which were not of unusual size.

His pupils reacted to light and accommodation, and converged properly. There was no mystagmus. The eye-grounds were normal. (This was confirmed by the ophthalmologist, Dr. S. Slomka, on several examinations.)

The boy was unsteady when standing, and swayed and fell to the right, and backward. Romberg test was an exaggeration of his station; he fell backward and to the right. The gait was of type where patient looked beyond the area of this immediate field of progression, the feet went forward, while body with head as pointer swayed, and fell to the right, and backward. There was no attempt at balancing when falling, the ground seeming to slip from under him, or rather, the ground seeming to pull the feet with it, and the torso and head seemed to go backward and to the right.

Voluntary motor power of face, tongue, mouth, palate was good and equal on both sides. Grips were equal; no awkwardness. Abdomen and chest showed no abnormality of muscular action. The lower extremities showed good power with no abnormality, when they were tested, with patient in bed.

There was no "air-pointing" of either, or one extremity, when patient arose in bed, or laid himself down again. This is seen both in cerebellar and cerebral lesions in a great majority of cases, and is as follows: When patient wants to sit up, the affected extremity projects into the air, straight from the hip at right angles to the trunk. This becomes more typical when patient lies down flat again; the affected extremity again assumes this position, but more positively. When there is doubt of a cerebral or cerebellar lesion, this is very useful in giving an index of the affected side. In cerebral lesions on the heterolateral side to the lesion. In cerebellar conditions as a rule on homolateral side. The latter statement requires more extended observation as an absolute statement.

There was adiadokocinosis and asymorgia on the right upper extremity from the first examination of the patient. Pointing tests gave on right side what I call prepointing. That there is a failure to reach the finger of the examiner. Left side gave past pointing. (The complete examination of these phenomena by otologists further on gave all the controversy.)

The only abnormality of reflexes was a slightly increased knee-jerk on the left side; other reflexes were all present, equally on both sides. The left side showed slight tendency to spasm on passive motion, somewhat like a mild Kernig reaction.

One day after admission, internal strabismus of left eye was first noted.

Vibratory sense present all over C.-256.

Five days later was noted a positive adiadokokinosis, and on the 15th there was prepointing right side, with past-pointing on left, internal strabismus. The grips remained equal until the 21st. Vibratory sense C.-256.

The boy at no time was unconscious, but became drowsy towards the end. During the two and a half weeks he was a very good little patient, intelligent, co-operative, and when not in pain very cheerful. At times he would scream out with pain even when asleep. Other times he would moan consciously and unconsciously. The pain of the head became localized to the right frontal and parietal region, which showed slight tenderness. He was able to feed himself until he became quite drowsy. He had to be isolated, as his outcries became more frequent and disturbed the whole ward. But it was quite a study to see the boy feeding himself and counting his small change when he was free of symptoms.

Eleven days after admission, the notes showed the boy to be very drowsy and making loud outcries. His pulse was becoming very slow and the vomiting was more frequent. Eye grounds were normal. No nystagmus. The lower part of the right side of the face showed some weakness. The right grip was not as firm as the left. (Boy was normally right-handed.)

Voluntary motion of lower extremities good. Patient when aroused could be made to sit up in bed. Abdominal reflexes present from both sides actively, also cremasseters. There was no Babinski, no Oppenheim. Malleolar reflexes negative. The plantar reflexes active. No Kernig. No sensory disturbances.

Two days before exitus the boy became very noisy, screaming all the time, and had to be given morphine. The headache he complained of was frontal. Pulse rate was 44. The condition continued. He vomited large amounts. Next day he became more restless and more noisy, though very drowsy. He took food until 10 hours before exitus. The pulse was 48 on April 26; the child died about 12, noon. Death was preceded by quieting of the patient, slight rise in temperature 100, pulse 52, respirations 18. During the entire course of the illness there was no abnormal temperature. When he entered the pulse rate was 82, respiration 42. Pulse rate gradually sunk between 40-50 and respirations between 18-20.

The laboratory findings and radiographs of skull were negative.

Urine: Moderate traces of albumen and showed some acotone. The blood examination: Red blood cells, 5,200,000, Hgb. 70 per cent

W. B. C. 12,400, differential, 75 per cent polynuclear and 25 per cent mononuclear.

Wassermann doubtful on two examinations. T. B. fixation was doubtful. The C. S. fluid on the 14th was clear, heavy with albumen, positive globulin. Copper reduced 10 cells to the C.-CM. 100 per cent lymphocytes. Colloidal gold curve 2344455321. Wassermann negative.

April 22 last lumbar puncture C. S. fluid clear, heavy albumen, no globulin, copper reduced, no cells, colloidal gold curve232221+000. Another colloidal gold curve between these two, 00+11+0000.

Throat Cultures—Negative.

Von Pirquet—Negative.

Examination by the otologist, Dr. A. Schwartz. Dr. Schwartz was checked up by Dr. S. Kopetzky.

April 17. Right drum: Healed perforation of anterior superior quadrant. Left drum: Healed perforation of post inferior quadrant. Slight redness of shrapnells membrane. Both drums markedly retracted. Early astrophic rhinitis. Caries of teeth.

Spontaneous past-pointing none.

To test horizontal canals:

1. Turning to right: Nystagmus 30 sec. to left (wide amplitude). Vertigo 17 sec. to left. Pass-pointing normal, both hands to right.

2. Turning to left: Nystagmus 30 sec. to right (wide amplitude). Vertigo 17 sec. to right. Pass pointing normal, both hands to left.

Caloric Tests: Irrigating ears with cold water (68) F.

Left ear: 1. To test vertical canals: (a) Vertigo, normal; (b) nystagmus, after 35 sec. markeed rotary to R.; (c) past pointing, normal, both hands to left. 2. Head back to test horizontal canals: (a) nystagmus, normal, horizontal to R.; past-pointing, normal, both hands to left.

Right ear: 1. To test vertical canals: (a) Vertigo, normal; (b) nystagmus, 90 sec. (probably much shorter), rotary to left; (c) pass-pointing, normal, both hands to right. 2. Head back to test horizontal canal: (a) nystagmus, normal, horizontal to left; (b) pass-pointing, normal, both hands to right.

Tests show reacting labyrinths on both sides and *their tracts.* The cochlea apparently is normal. The child hears well on both ears.

The diagnosis arrived at was that of cerebellar neoplasm. Conditions which had to be ruled out were epidemic encephalitis and tubercular meningitis. It was difficult to fully make sure of the

grounds for the diagnosis, as the usual concomitants of cerebellar involvement, that of the presence of nystagmus and choked disc, were absent. The report of the otologist increased the difficulty. Also there was no "air pointing" of the lower extremities and no sensory disturbance, but there was the falling on standing and walking, the asymergia and adiadokokinesis. The development of internal strabismus was of a disfunction type, showing that it was a supranuclear condition. The absence of a nystagmus indicated that the lateral lobes of the cerebellum were not affected. I have been told by Dr. M. Bernstein that the Vienna School holds the position that there will not be any nystagmus if there is no pressure from above downward against the dentate nucleus. All of these considerations compelled the diagnosis to be placed in the cerebellum above anywhere where it would press on the iter, where it would not impinge on the medulla containing the dentate nucleus, and away from the lobes of the cerebellum, and near where sun pressure could be exerted on the quadrigeninal bodies to account for the strabismus. The adiadokokinesis also was taken as possibly being in relation to a similar phenomenon that is seen in lenticulo-striate conditions, and so possibly the cerebello-cerebral fibres, of which a great proportion reach these nuclei, were involved. Hence a diagnosis of a lesion of a neoplastic character situated in the upper worm invading the superior medullary velum was made.

Unfortunately, the brain had to be removed in haste, and the necessary care in the removal of the specimen was impracticable, and photographing of it would not be of much service.

The right half of the brain is larger than the left; there are some slight ecchymoses on the surface of the pia of the convexity. The inferior surface of the lobes of the cerebellum and vermis is negative as to any abnormality.

The superior vermis shows a small cauliflower mass projecting anteriorly invading the superior peduncles nearly as far as the quadrigeminal bodies. It had also spread somewhat into the left cerebellar lobe. There is no lesion in the right cerebellar hemisphere, but some invasion of the sulcus on this side. The markings of the cerebellar hemispheres on both sides on section is normal macroscopically. The quadrigeminal bodies are intact. The inferior vernis is intact, and there is no invasion of any part of the cerebello-medullary-pontine angle.

The report of the character of the neoplasm by Dr. E. Moschkowitz is that of a large spindle-celled sarcoma, the nuclei of which are rich in chromatin and show the presence of many mitotic figures. The intercellular reticulum is comparatively slight.

The question of epidemic encephalitis was very difficult to leave out of the equation. The differential of the cell count of the cerebospinal fluid was distinctly not that found in that disease, also the practically complete lack of temperature and the mental condition of the patient where such as not seen in this effection.

I feel quite sure that without an autopsy we would not have been sure of the complete negation of epidemic encephalitis as a diagnosis.

Tubercular meningitis and cerebro-spinal lues were quite difficult to rule out on the same grounds as epidemic encephalitis. It is well to point out in this place the difficulty of transferring to paper the daily impressions of the clinician in his day to day contact with any case. Very likely an author could portray on paper the shades of difference as they present themselves to his mind and form his opinion, but the limitations of scientific nomenclature are such that we can only give in growth the picture for differentiation.

Here in this case the positive findings and not the negative possibilities make the diagnosis, and the quibbles of what the case might be did not make the case other than it was.

The writer thanks his colleagues for the privilege of reporting the case and for their co-operation.

1326 Madison Avenue.

NICOTINE POISONING OF THE INNER EAR; A PRELIMINARY REPORT FROM ANIMAL EXPERIMENTATION AND MICROSCOPIC FINDINGS. (FROM THE PHYSIOLOGICAL DEPARTMENT OF COLUMBIA UNIVERSITY.)*

DR. OTTO GLOGAU, New York.

John Nico, the French Ambassador to Portugal, in 1560, presented to Queen Catherine De Medici, in Paris, the ground powder of the magic Indian plant, tobacco. Since that time modern civilization has its nicotine problem. Similar to alcohol, nicotine became a necessity in social life, whose pleasures are enjoyed by millions of people. In the course of years it was, however, found that nicotine, similar to alcohol, is not only a stimulant, but also a poison. The toxic influence of excessive nicotine use, such as occurring in chronic smokers, has been both clinically and experimentally proven. Be-

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sides the cardio-vascular apparatus it is first of all the nervous system that suffers through nicotine poisoning. Different authors, especially Von Frankl-Hochwart, established the fact that nicotine poisoning may cause impairment of hearing, leading to deafness, vertigo, dizziness, and other symptoms of disturbed vestibular function. These clinical observations, pointing to nicotine poisoning of the inner ear, were up to now, however, not controlled by animal experimentation. I therefore undertook to observe in a number of animals first the clinical symptoms and then the microscopic findings of nicotine poisoning of the inner ear. During my last stay in Vienna the subject was suggested to me by Prof. Heinrich Neuman. I was fortunate enough to carry out the first experiments at the Physiological Institute of the University of Vienna under the guidance of Prof. Kolman. Due to my rather short stay at Vienna, I could only deal with acute nicotine poisoning of the inner ear. In a number of guinea pigs and pigeons nicotine poisoning was experimentally brought about. It is as yet undecided whether the nicotine or the pyridin bases are the poisonous substances of the smoke. For this reason a number of animals were injected either subcutaneously or intraperitoneally with nicotineum purum or nicotinum tartaricum. A number of animals was exposed to the inhalation of smoke. The animals were put under a large glass bell that had on top an opening covered by a rubber plug with two perforations, into which glass tubings were tightly fitted. One tube served for the intake of fresh air; the other tube was connected by means of a rubber tubing with a specially constructed glass pipe, into which a burning cigarette was put. Over the opposite end of this glass pipe a rubber tubing was fitted which led to an electric pump. Thereby the glass bell was filled with the smoke of the cigarettes, to which the animals were exposed daily for a certain length of time, till symptoms of nicotine poisoning occurred.

Through the kindness of Dr. Pike I was enabled to continue the experiment at the Physiological Department of Columbia University Since for practical purposes only the symptoms due to inhalation of tobacco smoke are of importance, the injection of nicotine was discarded and I restricted myself to exposing the animals to smoke Dr. Pike was kind enough to construct for me a very practical apparatus.

The apparatus used for subjecting the animals to smoke was simple. The main part of it was a small motor-driven rotary pump with an inlet pipe on one side and an outlet pipe on the other. The stem of a pipe filled with tobacco was pushed into the free end of a rubber tube, and the other end of the tube attached to the inlet pipe

of the pump. A T-tube or side valve was introduced in the rubber tubing a few inches from the pipe holding the tobacco. Another system of tubes was led off from the outlet pipe of the pump to glass tubes bent once at right angles and thrust through corks fitted into holes bored in a wide board. The bent glass tubes were trust up from below so that their free ends projected several inches above the upper surface of the board. A second shorter glass tube was fitted into another hole in the board a few inches from the point at which the bent glass tube entered. Both tubes could then be covered by a large bell jar 25 cm. to 40 cm. in diameter. The pigeons or guinea pigs were placed under the bell jar and the pump started. Smoke was blown through the bent glass tube into the bell jar, and air escaped through the short glass tubes. The amount of smoke blown in was regulated by opening or closing the T-tube between the tobacco pipe and the pump, and the animals watched through the top and sides of the bell jar. If the smoke in the bell jar became too dense, opening the free end of the T-tube would admit more air. If more smoke was desired, the free end of the T-tube was closed.

The animals were exposed to the smoke till they showed symptoms of poisoning, the pigeons vomiting and tension cramps, and the guinea pigs trismus and disturbances of equilibrium. While at the Vienna Physiological Institute the animals were exposed to smoke from between three to four weeks; at the Physiological Department of Columbia experiments were carried on for four months. Consequently we have here to deal with the symptoms of chronic nicotine poisoning. Special care was taken in the method of killing the animals and preserving and preparing the specimens for microscopic examination. I will briefly mention the technic employed.

Technic. In order to obtain the most ideal conservation, without post mortem changes, the animals were transfused in vivo during ether narcosis. In the pigeons the breast muscle, laterally on the breast bone, was smoothly and dully disected. The breast bone was then cut out by two clips of the scissors without severe hemorrhage occurring. Then the heart was exposed within the pericardium, the right ventricle was then opened through one clip of the scissors, and through a puncture into the apex of the left ventricle a correspondingly formed small olive of a canula was introduced, that was connected with a rubber tube of one-half meter length leading to a funnel.

All these parts were filled with Ringer's solution, warmed to body temperature and shaken somewhat with amylnitrit (to widen the blood vessels). This fluid was sent through the vascular system of

the animal, avoiding the formation of air bubbles, till from the right ventricle pure fluid came without blood.

With the pigeons it was necessary, before opening the heart, to inject into the latter one cc of an extract of the heads of leeches (hirudin), in order to avoid the extremely quick coagulability of the blood of these animals. With the guinea pigs this was not necessary. In the guinea pigs the sternum had not to be removed, but was only split open in the middle line with the scissors. After the solution came clear from the right ventricle, the fixation fluid was immediately poured into the funnel, on top of Ringer's fluid, when the latter had reached the neck of the funnel.

The fixation fluid consists of: 5 gr. potassium bichromate, 80 gr. water, 10 gr. of 40 per cent formalin and 3 gr. of glacial acetic acid. This fluid, too, was sent through the vascular system of the animal till it escaped for some time from the right ventricle. The perfect success of this transfusion is followed by a cramp like extension of all muscles of the animal with simultaneous stiffness. Thereby, all parts adjacent to the capillaries become conserved instantaneously, those somewhat remote, shortly afterward. Thereafter the temporal bone on both sides, usually in connection with the base of the skull and the cerebellum and the medulla oblongata was prepared and put into the above described fixation fluid for one week. In the pigeons this time is sufficient for the total decalcification of the tender bone; in the guinea pigs it takes two or three weeks, whereby the fluid must be changed twice. The smaller pieces are then transferred into a 1 per cent solution of osmic acid, whereby the medullary sheaths and other parts containing fat and lipoid stain black. After short irrigation, the pieces are then transferred for one day, first into a 50, 80, and 95 per cent solution of alcohol. Finally, they remain for two days in a solution containing alcohol and ether in equal parts. Then the pieces are transferred for one day into a 3 per cent celloidin solution. Following this two ways of procedure are possible. We add celloidin or thicken the solution till the consistency of a thick syrup, and then imbed the pieces directly with celloidin by pouring the object together with the thickened celloidin into a small paper box; this is permitted to become rigid in chloroform and is the next day transferred into a solution of 70 per cent alcohol; then the cube is removed from the little paper box and glued upon the wooden square of the microtome by means of a celloidin solution. The other way of procedure is only recommendable in pigeons. The object within the 3 per cent celloidin solution is made to become rigid within a small paper box. There, the surrounding chloroform is changed four times, once every day. From the last chloroform

the object is directly transferred into the incubator, within paraffin. Thus an imbedding of celloidin paraffin is brought about which permits the gluing of serial sections of the glass. These sections are glued upon the glass slide by means of albumen-glycerin and must be pressed upon with smooth filtrating paper, after having been lightly warmed. They are then brought over night into the incubator to be dried. The glass slides thus prepared are then transferred into xylol to be freed from paraffin and then into 50 per cent alcohol, then into distilled water and then remain one night within a saturated solution of iron-ammonium-alumen. The next day they are well irrigated with distilled water, then they are stained over night in a solution consisting of equal parts of hematoxylin haidenhain (1 per cent solution of hematoxylin in 70 per cent alcohol) and molybden-hematoxylin, after Held. They are then again differentiated within the first solution till the details are clearly seen. This must be done under control with a medium magnification. The slides are then irrigated with distilled water and transferred for several hours into alkalin sink water. The sections are then transferred from 95 per cent alcohol into terpineol, then into xylol and are then enclosed within damarlack; thus simultaneously all details of the sensory cells, the supporting cells, nerve cells, fibres, nuclei, etc., are clearly brought out and eventual pathologic changes are distinctly visible.

It will take quite some time before it will be possible to give a final report on these experiments, since serial sections of the inner ear of so many animals have to be made and examined. This introductory report is made to put our work on record. A preliminary statement may be made which, however, might have to be considerably modified when the final results of our observations are at hand. Nicotine poisoning of the inner ear is characterized by certain pathological changes within the nuclei of the cells of the vestibular ganglion of Scarpa.

64 E. 91st Street.

CHRONIC CATARRH OF THE NASO-PHARYNX.*

Dr. D. J. Gibb Wishart, Toronto, Ont.

My choice of subject for this evening's paper was due to a gift made me a few months since by Surgeon General Ryerson of the two volumes entitled Diseases of the Throat and Nose, published by the late Sir Morell Mackenzie in 1884, a perusal of which has afforded much of interest and enjoyment. It is only by reading such classics as these volumes, now 38 years old, have become, that we arrive at once at an idea of the progress the specialty has made here and there, and also at the knowledge that we are prone to forget what has been proven, try out again old remedies, and really stand still with regard to much of our knowledge of disease.

It will be necessary to quote liberally from this work to enable you to orient yourselves. Chronic catarrh of the naso-pharynx, we are told, is synonymous with "Post Nasal Catarrh, Retro-Nasal Catarrh, Follicular Disease of the Naso-Pharyngeal Space, and American Catarrh," and is defined as "chronic inflammation" of the lining membrane of the naso-pharynx, giving rise to a more or less viscid secretion, the adhesion of which to the part causes a most disagreeable sensation and induces the patient to make frequent efforts to get rid of it by "hawking" and "clearing the throat." This disease, we are further told, was first described by Frank in 1794 as "a form of chronic catarrh, the seat of which is the pharynx"—then by Dobell 1854—Wendt 1874—Lennox Brown 1878—by Beverley Robinson of New York in 1880—under the title of Follicular Disease of the Naso-Pharyngeal Space—to whom Mackenzie refers as the only American practitioner who appears to have seriously investigated the subject—and finally by Bresgen in 1883. Unfortunately I have been unable to secure a first edition of Robinson's monograph—Nasal Catarrh and allied diseases—and have been forced to rely upon the second, published in 1885, wherein, however, we have the advantage of his reply to Mackenzie's remarks of the year previous. This second edition, I may remark, is dedicated to the late Professor Meigs of this city.

The present day specialist who obtains his idea of post nasal catarrh from the last edition from the pen of our colleague, Wendell Phillips—where the subject occupies a bare page and a half in a volume of 831 pages—is aghast when he turns to these works of the early eighties to observe that Beverley Robinson devotes 49

*Read before the Philadelphia Laryngological Society, March 7, 1922.

pages in a volume of 269, and Sir Morell Mackenzie 11 out of 1139 to this disease. The space devoted, and what is said about it in this space has undergone a wonderful change in these 40 years, and this aspect is one which I propose to discuss and analyze tonight.

Robinson refers to the etiology of this disease as follows: "In New York, Boston, and Philadelphia, in many of our Western cities, on the seashore, and in the interior, in fact, over widely extended and very different sections of our country, post-nasal catarrh prevails to an extent which originates much inquiry, and occasions more than passing anxiety to those who have observed its course. Vast numbers of people are already affected with it. Men, women, and children are alike its prey." "All ages and professions are subject to its symptoms and complications." And Mackenzie after quoting the above citation, goes on to say that in a recent tour through that country (U. S. A.) "I had a very favorable opportunity of studying the complaint. For I not only saw examples of the disease over a very wide tract of country, but also observed the atmospheric conditions under which these cases occurred, enjoying, moreover, the great advantage, in many localities, of discussing the subject and hearing the views of able physicians who have been studying the disorder on the spot for years. I was greatly astonished at the extremely wide diffusion of the affection. I met with it all over the Eastern States, it was very common in Chicago and St. Louis, which may now be called the central cities of America, I found it prevalent in Nebraska and to a slighter extent in Utah, and again I encountered it on the Pacific Coast, finding it of frequent occurrence in San Francisco. I had not the opportunity of seeing any patients in Nevada, as I merely traveled through that State without stopping; but in London I have treated many American travelers for post-nasal catarrh who had acquired the disease on the alkaline plains of the Silver State. I also saw a good many patients suffering from catarrh of the naso-pharynx in Colorado. In Southern California and Arizona I scarcely met with any cases, and in Canada the affection, though much more common than in Europe, did not seem to be so universal as in the States. American catarrh, and it would seem, principally prevails between latitudes 44 and 38."

With such an affection of "vast numbers," "men, women and children," it is small wonder that Robinson refers to the disease as the "subject of much thought and investigation," and that Mackenzie states that the term "catarrh," "exceedingly common in America"—refers to Catarrh of the Naso-Pharynx.

The post-nasal catarrh of 1880 was something to be taken au serieux. It is not so today. Why?

The definition of Mackenzie has been quoted above—that of Robinson characterizes the disease as having two symptoms, "a sensation of stuffiness or oppressive fullness in the posterior portion of the nasal passages, and a falling down from above the palate of a varying quantity of mucus." The definitions of today are to all intents and purposes the same as those of 40 years ago. Has the disease lost its terrors, or is it less commonly met with?

There seems to be no doubt that, while the intention was to limit the picture to the symptoms given above,—the observers of 1880 did not stick to their "last"—for I find Robinson goes on to speak of "a fetid and most offensive odour" and "abrasions, an onward step to ulcerative degeneration and necrosis." The discharges come, it is stated, from the glandular follicles situated at the vault—and on the lateral walls of the naso-pharynx—the post-ethmoid cells and the posterior extremity of the turbinal—and may choke the patient, and he cites the case of a patient, "aged 6 years, who would waken strangling at 2 a. m." Surely the negative has been re-exposed (used more than once) and we have a super imposed picture of atrophic naso-pharyngitis, of tuberculosis, of syphilis and in the case of the small child of adenoids.

The illustrations are also deceptive, for on page 119 are found, side by side, a figure from Solis Cohen depicting "posterior swelling of the side of the septum," and another from Lennox Browne of "glandular hypertrophy of the vault." The former is correct, but the latter is surely adenoidal.

Turning to the complications, the first mentioned by Robinson is "hypertrophy of the soft tissues of the turbinate, frequently due to catarrh, or to faulty treatment thereof." By present day views this is putting the cart before the horse. The same may be said as to inflammation of the lachrymal sac, empyema of the antrum, enlarging spongy tonsils, dysphonia, impaired vocal powers, loss of memory, ulceration of the septum, turbinates, polypi, etc., all of which are mentioned at considerable length. Catarrhal inflammation of the eustachian tube alone remain unchallenged.

I have referred briefly above to the etiology, for the purpose of awakening your interest; some further reference will be worth while.

The problem of the cause is considered unsolved by Robinson, but he evidently leans strongly to the theory of the "catarrhal diathesis," as opposed to the opinion of Niemeyer that "nasal catarrh is local in its nature and cause." "Moderate differences or changes of climate," he says, "only partially affect its growth. In individual instances its onward and rapidly progressive march appears to be

somewhat delayed, if not completely arrested, by breathing a high, equable, and dry atmosphere, or by respiration of air impregnated with balsamic odors. In other and numerous examples, when once the catarrhal affection has become firmly seated, it is but little influenced for the better by the most rational hygiene and an ambient medium, seemingly the most perfectly adapted to individual need. Usually speaking, however, a cold, damp atmosphere, subject to sudden and great changes of temperature, is supposed to be a general and efficient, if not exclusive, cause of the production and extension of post-nasal catarrh. No doubt this accepted belief has some basis in fact, and yet the more closely I have been able to investigate the subject, in its multiple aspects, the more thoroughly am I persuaded that the received opinion is in part erroneous."

"The development of the malady is not much affected by habit or occupations, and strong and weak organizations are similarly attacked. No constitution is entirely exempt, but certain persons are more disposed to contract it than others."

"While I believe, therefore, that certain accidental conditions may be instrumental in developing its manifestations, I am equally convinced, that unless a special constitutional tendency exists in the individual, he will but rarely take it and develop it to any great and annoying degree. Post-nasal catarrh must not be confounded, as it almost universally is, with ordinary rhinitis. It is not simply an acute and chronic inflammatory condition of the pituitary membrane, nor should it, therefore, be treated in the same way; for, if it is, almost signal failure will follow our every effort. An acute or chronic coryza is, without doubt, a predisposing and, at times, a proximate, and partially efficient, cause of rhinitis; but, in order to effect the grafting of post-nasal catarrh upon the nasal and pharyngeal mucous linings in a permanent manner, a certain diathetic condition is essential The affection has existed in germ previously, so to speak, and by reason of one or more attacks of cold it takes on its full growth, and changes from latent to obvious, as regards both its pathology and symptoms."

The diathesis, which is present, is called, for lack of a better term, "catarrhal."

On the other hand, Mackenzie lays the blame upon dust, or rather irritation. "My travels in America," he says, "were made in the latter end of August and in September and October—that is, during the most favorable season of the year—and I have little doubt that had I been there in the winter I should have seen a great deal more of this widespread ailment. In many of the regions referred to there

are local conditions which tend to irritate the mucous membrane. Thus, all along the Eastern seaboard the atmosphere during the winter months is cold and moist, whilst in the summer it is excessively hot. In San Francisco fogs prevail in the summer in the early part of the day, whilst in the afternoon a cutting wind blows continuously. In Colorado, on the other hand, the climate is so extraordinarily dry, that only those who have been there can thoroughly appreciate it. The inhabited portion of the country consists of extensive plains situated at an elevation of 5,000 or 6,000 feet above the level of the sea. The dryness of the climate may be gathered from the fact that not a drop of rain falls during nine months of the year, the result being that no trees can flourish, the scrub oak being almost the sole representative of forest trees, and this being only found in the narrow valleys and canons, as they are called. Indeed, so dry is the soil that not infrequently all the prairie grass perishes. The atmospheric conditions, though admirably suited for some forms of consumption, are nevertheless extremely irritating to the mucous membranes of many persons. The white alkaline dust which covers hundreds of miles in Nevada is also met with here and there in Colorado. In winter and spring the winds are often strong, and it will be easily imagined that at such times the abundant dust of this extraordinarily dry country is very irritating."

"The soil of the American continent varies so widely in different parts that it is impossible to suppose that it is concerned in the etiology of the affection. Again, it will be readily understood that the meteorological conditions over this vast area are so various that they cannot be regarded as a cause acting with anything like uniformity. The general character of the atmosphere of the American continent, as compared with that of Great Britain, and also with most parts of Europe, is that it is drier, that the changes of temperature are more sudden, and the extremes of heat and cold greater. There is nothing, however, in these conditions to account for the localization of the complaint in the naso-pharynx, and it would seem that post-nasal catarrh is not due to what may be strictly called climatic influence, but to something which is accidentally introduced into the atmosphere of widely differing localities; in other words, that there must be irritant particles floating in the air over very wide areas. This is actually the case, for dust is to be found everywhere in America."

"The universal prevalence of catarrh is indeed fully explained by the abundance of dust, both in the country and in the cities. Owing to the immense size of the country, and its rural population, the

country roads have not, as a rule, been properly made, and except in some of the older States are merely the original prairie tracks. In the cities, notwithstanding the magnificence of the public buildings, the splendor of many of the private houses, and the beauty of the parks, the pavement is generally worse than it is in the most neglected cities of Europe, such, indeed, as are only to be found in Spain and Turkey. It must be recollected also that whilst in the decayed towns of the Old World there is very little movement, in the American cities there is a ceaseless activity and an abundance of traffic. Hence the dust is set in motion in one case, but not in the other. The character of the dust, of course, varies greatly according to the locality. In some parts it is a fine sand, in others an alkaline powder, whilst in the cities it is made up of every conceivable abomination, among which, however, decomposing animal and vegetable matters are not the least irritating elements. An idea may, perhaps, be formed of the state of the atmosphere from a consideration of the fact that in many cities the functions of the scavenger are quite unknown."

"That a dusty atmosphere is the real cause of post-nasal catarrh is rendered probable by a consideration of the anatomical relations of the naso-pharynx. For owing to its being a cul-de-sac out of the direct line of the respiratory tract, particles of foreign matter which become accidentally lodged in its upper part are got rid of with difficulty—most likely by an increased secretion, which, as in the case of the conjunctiva, washes away any gritty substance which may temporarily alight on the membrane. In the larynx, irritating dust is dislodged by coughing, which may be either reflex or voluntary; and again in the case of the nasal passages, the minute particles of matter which constitute dust are expelled, if they happen to be obnoxious, either by sneezing or blowing the nose. But reflex acts, such as coughing and sneezing, have no effect upon the upper part of the naso-pharynx, and it is only by a voluntary effort, known as 'hawking,' that this cavity can be partially cleared. It is probable also that owing to the sensibility of the naso-pharyngeal mucous membrane being less acute than that of either the nose or the larynx, minute foreign bodies accidentally lodged in the vault of the pharynx do not cause an amount of discomfort at all corresponding to that in the adjacent parts; hence particles of matter are more likely to remain in situ for a long time in the post-nasal region, than in either of the other parts, and are, of course, very apt to set up disease. In this country the complaint is most common in persons whose pharynx is large in the anterior posterior direction, a form

of throat which facilitates the entrance, without favoring the expulsion, of foreign particles."

Mackenzie adds that dust, although the most frequent, is only one cause, and that many circumstances favor its development, "thus I have noticed," he states, "that in many cases the sufferers have been persons who partake largely of pungent condiments and the habit (almost universal in America) of taking sauces and pickles with every dish may be concerned in the production of the disease."

And then, quoting Robinson's views of catarrhal diathesis, says: "It would appear that he does not attempt to circumscribe the diathesis too closely, for in reference to this complaint he observes that 'while follicular disease is at times due to the catarrhal diathesis pure and simple, so it may be and frequently is attached to the gouty, herpetic, syphilitic, scrofulous, and tubercular. The malarial influence may likewise be evident.'"

That in that portion of this continent between the 38th and 44th parallels chronic catarrh of the naso-pharynx was considered indegenous is amply evident from the quotations given above, but to what extent was it to be found elsewhere? Apparently England and the Continent knew little of it. Robinson asks "how is it that a disease which is so prevalent in many sections of our country is certainly less known and familiar in England and on the Continent?"

Mackenzie speaks of having often seen foreigners making a short stay in America becoming affected with post-nasal catarrh, but does not afford internal evidence of finding cases native to the British Isles, and his description of the symptoms, etc., might be taken from a modern text book, all reference to Robinson's complications being omitted, except the involvement of the eustachian tube, nor does he criticize the statements of Robinson in this connection. Lennox Browne, however, in his Diseases of the Throat, first edition 1878, combats the "use of the anterior nasal douche in cases of post-nasal catarrh of such long standing that excoriation and ulceration of the mucous membrane and sub-mucous tissue of the nasal passages, and even necrosis of the turbinated bones, has taken place," p. 164, and elsewhere speaks of the diathesis as scrofulous.

I must confess to a difficulty in understanding the precise point of view held by Woakes in discussing post-nasal catarrh. It would appear, however, that he considers the pharynx as a whole, not differentiating the naso-pharynx from the oro-pharynx, as when he states that "chronic catarrh, whether nasal or pharyngeal, or both, is essentially a neurosis (viz., a permanently dilated state of the

blood vessels), and embraces both in the term 'Hypertrophic Catarrh of the Pharynx.'"

That his view of the origin of the symptoms, which are the same as those stated by Mackenzie, has become the modern view will be recognized from the following quotation (p. 128), where, after speaking of an irritation at the back of the nose, with a desire to hawk and clear away mucous from the throat, he goes on to say "the meaning of this change is that the anterior nares have become permanently occupied, as regard the lowermost channels, with hypertrophied mucous tissue." This is confirmed in an earlier statement, where in discussing the involvement of the hearing he says: "It is important to bear in mind, that it is chiefly the inferior meatus or channel of the nose which contributes to the Eustachian function; hence the importance attached in this treatise to the potency of the inferior meatus, and the attention given to the diseases which interfere with its normal state: For it is obvious that if this view be correct, the tube is equally liable to obstruction from stenosis of the inferior nasal meatus as it is from a similar condition occurring in any part of its length."

Referring to the work of Solis Cohen, published ten years earlier than that of Robinson, while he describes the sub-mucous infiltration of the sides of the vomer posteriorly as existing to a very limited extent in cases of ordinary chronic coryza, I cannot find any reference to chronic catarrh of the naso-pharynx as a distant entity. The several symptoms of the disease. including impairment of hearing, are enumerated as part of the picture presented by chronic follicular pharyngitis, however.

Nomenclature in medicine should be definitely standardized, if one is to read intelligently, but with almost daily fluctuations in the advance of medical science and investigation, this becomes probably impossible. Still the pharynx is a definite anatomical structure, with a continuous posterior and lateral walls, as a whole forming part of the respiratory tract. Why, therefore, should an imaginary boundary formed by the intermittent raising of the soft palate divide disease of the naso-pharynx from that of the oro-pharynx? This leads to a confusion of thought. Mackenzie deals with pharyngitis as a separate and distinct entity, and in the first part of his first volume, while the affections of the naso-pharynx are treated near the end of the second volume. Robinson, however, states that follicular disease of the naso-pharynx, or post-natal catarrh, is identical with follicular disease of the pharynx, by which he means oro- and perhaps laryngo-pharynx, differing only in locality and the special symptoms due thereto.

The fact that impairment of hearing is given as a symptom of pharyngitis by Cohen and others further shows the confusion of thought to which this arbitrary division of territory has given rise.

We have in chronic post-nasal catarrh, as originally described, it seems to me, a disease which as a distinct entity has disappeared, not through a change in climate or diet, or hygienic surroundings, or the absence of dust, but because we classify our diseases more correctly, and, more important still, because we appreciate better, and are more fully determined to secure a maximum of normal nasal respiration for our patient. Snaring the posterior ends of the inferior turbinal, and resecting the septum, has done more than aught else to effect this change, because with free nasal breathing the membranes of the naso-pharynx do not swell and secrete as where nasal obstruction exists, and in other cases, our improved technique for posterior ethmoiditis and empyema of the sphenoidal sinus has prevented the onset of post-nasal catarrh.

My explanation is partially borne out by the statement of recent writers. Phillips, 1919, states "this disease rarely occurs independently of chronic hyper-plastic rhinitis." Dan. MacKenzie, 1920, states that "post-nasal catarrh is in reality a secondary effect of some other disease and the treatment is the removal of the cause," and Syme, 1920, confirms this by saying tersely that "chronic naso-pharyngeal catarrh is as a rule a diagnosis of inefficiency." When I began to practice, the post-nasal syringe and brush were a necessary portion of my outfit, but these have long been relegated to the "shelf of discards."

I asked a few of my friends for their impressions as to the increase, decrease, or disappearance of this affection, and had written all the preceding part of this paper before I ventured to read their replies, and now I find myself in difficulties, for I have nearly as many varieties of view as I have communications:

Canfield: "I have the impression that a number of cases of chronic catarrh of the naso-pharynx are appearing in people whose adenoids and tonsils have been operated upon. I am inclined to think that our various surgical procedures directed toward the nose itself, while they may do our patients a great deal of good, are not altogether unmixed blessings. They certainly produce trophic changes in the nasal mucous membrane, some for the better and some possibly for the worse."

Beck: "Secondary nasal pharyngitis is the commonest form I see."

Birkett: "Perhaps a decrease."

Chamberlain: "No increase or decrease."

Craig: "Fewer, due to improved hygienic conditions and better diagnosis."

Dean: "Apparent decrease."

Freudenthal: "Lack of humidity responsible for 99 per cent of cases. Heating system entirely responsible for increase or decrease."

Halsted: "A decrease."

Hill Hastings: "Cannot notice any increase or decrease. Have come to regard it more and more as secondary to other things."

Hubbard: "Conditions formerly labeled naso-pharyngeal catarrh seem to have quite disappeared."

Jervey: "Cases have responded satisfactorily only when primary disease is brought under control, diseased tonsils associated."

Levy: "Very little, if any, decrease."

Loeb: "My experience and observation have not added much to my knowledge."

McKinney: "No change. Cases are not ethmoidal in origin."

Murphy: "On the increase, or our technique of examination has improved."

Phillips: "A marked decrease due to the fact that children are more carefully watched and treated."

Richards: "A lessening generally, but an increase in winter from dry, over-heated houses and also where in adenoid operating a considerable amount of underlying tissue has been removed as well."

Roy: "No change. Undue operations upon the posterior ethmoid cells and sphenoid produce an exaggerated condition of this symptom in the naso-pharynx."

MacCuen Smith: "Benefit quite marked in many instances by providing free nasal respiration."

Shambaugh: "Rather impressed with the increase resulting from unwarranted nasal operations—septal, ethmoidal and turbinal."

None of the above has noted any anatomical peculiarity, and the observation of Mackenzie as to the antero-posterior lengthening of the naso-pharynx is not substantiated.

Dr. Fruedenthal was kind enough to send me reprints of his studies upon catarrh of various varieties, and I must make my position clear lest I fall foul of that redoubted warrior. I am here discussing the purely chronic post-nasal catarrh described by Robinson in 1883, and styled by Mackenzie, American catarrh, and have no intention of intruding upon the domain of atrophic catarrh, nasal catarrh, or aught else than the subject mentioned.

My impression after reading Robinson's lurid picture and those of many other early writers is that we should hasten as rhinologists to discard the term catarrh from our text books and speech. Is falling down of a discharge not simply a symptom giving little or no clue to its cause? Will any one of us allow a patient to dictate to us as part of his history that he has catarrh? For many years my "come-back" to that inane remark has been "that is not a disease; tell me what you mean by catarrh."

This term has been the mine of wealth to many a charlatan, and these descriptions, to which I have referred above, have afforded these charlatans all the pabulum they needed, stated definitely as the published views of sound rhinologists.

The investigation of the etiology of post-nasal catarrh issued by Freudenthal in 1894, establishing his theory of the diminuation of humidity as the cause of 99 per cent of all cases is very convincing, but it is not because the humidity has been seriously increased in our dwellings and places of work that the post-nasal catarrh of Robinson has decreased, and I believe practically disappeared, nor can the appearance of atrophic rhinitis, or post-nasal dropping due to abnormally increased nasal respiratory power, the result of sub-mucous resections, turbinectomies, evisceration of the ethmoid cells, or the lessened secretion of the mucous membrane of the pharyngeal vault by too zealous curettage of the adenoid tissue and its adnexa be considered as giving the lie to my statement.

That the operating zeal of the sans culottes who are filling our ranks today will bring disaster is too true. They can operate, but they cannot diagnose, and if a few of them were mulcted in heavy damage suits by the victims, perhaps Shambaugh would not be correct when he says that "oto-laryngology has too long served as the catch basin for derelicts in general medicine who have sought some dabbling knowledge in our specialty which will enable them to do some operative work of doubtful value to the patient, and too often on the basis of this, to renounce their practice and become spurious oto-laryngologists."

I have been intentionally guarded in my statement as to the beneficial effect of operative treatment, for I join with Canfield, Richards, Roy, and Shambaugh in believing that I have seen definite reason to infer that indiscreet operating is beginning to develop a new crop of post-nasal catarrh. The imbalance by which the current of air was diminished unduly, is replaced by an imbalance in which the current is too great, producing something similar to an atrophic state.

Just the other day a confrere whose septum I had resected in 1913—obtaining a perfect result—complained to me of some symptoms suggestive of a commencing atrophic condition.

Last week a first year medical student came to me complaining of post-nasal collections, and here it was found that a country practitioner had removed the posterior three-quarters of an inferior turbinal by way of re-establishing normal nasal breathing.

There is at present an onslaught by the novitiates in rhinology, worse than the Armenian massacres, upon slight septal deviations, swollen turbinals, and tonsils of whatever size, which has no excuse and is purely needless surgery. Time after time have I known of patients being subjected to operations for conditions which I had conscientiously advised should be dealt with without operation, and my senior confreres tell me that their experience is similar to my own. Such malpraxis will assuredly react upon its perpetrators, but the victim remains victimized and, as the Scripture has it, "the last state of that man becometh worse than the first." A needful preliminary, however, to a campaign against this pernicious practice, would be a thorough and faithful review of post-operative results, by the older members of the profession, and I trust such a review will be called for by one of the leading Special Societies.

I have not deemed it necessary to discuss the catarrhal diathesis theory of Robinson—it, like the scrofulous diathesis theory, has passed into oblivion.

From all the above it is therefore evident that while much of the description of the cause and effect of chronic naso-pharyngitis as published in the early eighties is now properly condemned as incorrect and misleading, and the disease as then understood has to a large measure, if not entirely, disappeared, it is also evident from the comments quoted from the letters of my correspondents, that there is still a confusion of thought upon this side of the water regarding this complaint, and that we are apt to fall into the error of using old terms and expressions to describe conditions, forgetful of the fact that the meanings of these very terms and expressions have become transmogrified.

As we have learned to recognize that swellings of the lateral walls of the oro-pharynx, or a granular appearance of the posterior wall of the same region, are assuredly due to causes located elsewhere, so we must recognize that hawking and droppings and a full sensation behind the nose are in like manner due to causes located elsewhere, and refrain from dignifying these as symptoms of a disease confined to the naso-pharynx.

The physician is informed by his patient that his ankles are swollen, or his eyelids puffy, and being well trained he at once examines the kidneys and the heart, and our patient must in like manner be taught that the symptoms formerly ascribed to the naso-pharynx are the logical result of defective nasal breathing of long continued duration, and depend upon pathological conditions in the nose.

We must avoid speaking in loose terms, which convey wrong impressions, and thus boost the correspondence practice of fakirs on catarrh. If we speak loosely we are apt to think loosely, and therefore fail to trace the symptoms to their true cause, and I believe that where the symptoms are only of recent origin, the cause can be found, and with its removal these symptoms will disappear; on the other hand, where the membrane of the naso-pharynx, from long neglected primary causes, has undergone changes of structure which are permanent, we must recognize an established condition, but not a disease.

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47 Grosvenor Street.

"THE AFTER RESULTS OF THE DIFFERENT METHODS OF TONSILLECTOMY, WITH SPECIAL REFERENCE TO THE LA FORCE AS COMPARED WITH THE ORDINARY DISSECTION WITH SNARE. A CRITICAL REVIEW OF 200 CASES."*

DR. REESE PATTERSON, Knoxville, Tenn.

When one ventures to present a paper on a subject such as I have selected for this evening, he has the feeling that perhaps some words of apology might be in order, because of the vast amount that has been written on every conceivable phase of the tonsil. In the last few years hundreds of articles have been written upon this subject.

However, when one stops to reflect that at least 75 per cent of the operative work performed in the field of oto-laryngology is on the tonsil, he is persuaded that its continued consideration is no more than is due this important subject.

This paper is presented from the standpoint of a student of oto-laryngology, rather than that of one claiming the title of specialist. The writer has now been a student in the post-graduate school of the University of Pennsylvania nearly two years. When he entered the department of oto-laryngology it was a new field entirely, as his previous work was that of a general practitioner. Therefore, no previous training or experience have any bearing or influence on deductions in this paper.

To those of you who are not familiar with the method of instruction of the student, I will state that he is at first permitted to see the operation, noting in detail the particular points of technic in the method carried out by his chief. Later he assists, and in a short while he is performing the operation under guidance and helpful criticism of the instructor. By this procedure the student is afforded the finest opportunity to become skillful in the performance of tonsillectomy, and well versed in the method taught, since the several large clinics of the University afford an abundance of material, each having a chief and coterie of assistants, all of whom show the finest spirit of helpfulness and a real desire to be of service.

As one who is not a Philadelphian I would like to digress just here, and pay a tribute to that splendid band of physicians, who week after week and month after month toil unceasingly in lecture-room

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and clinic, in laboratory and operating-room, teaching by word of mouth, by precept and example, the younger members of the profession. This service is given without money and without price. I believe that no city can boast of finer altruistic spirit than that found in the profession of Philadelphia.

This plan of teaching is continued for a certain number of weeks, when the student is shifted to another operative clinic. Here he is introduced to other methods of performing tonsillectomy, by the same careful process and under equally competent instructors.

This plan of procedure is carried on throughout the first year, so that by the end, the student physician has had ample opportunity to become thoroughly familiar with all the usual methods of performing tonsil operations, and fairly proficient in the actual operative technic. In addition to this he gains another most important item of information, namely, the comparative results, good and bad, of different methods employed.

A similar course of instruction on diagnosis, treatment and post-operative results, is carried on at the same time in the out-door clinics. It was while doing routine examinations in this department that I was first impressed with the poor results obtained in so many tonsil cases. Parts of tonsil tissues left behind, pillars badly deformed and often entirely gone, soft palate pulled to one side, cicatricial contractures, giving rise to a great amount of pulling sensation in the throat and a peculiar tense look of the velum palate. As I watched these too ofttime unfortunate results from the operation which we as specialists perform so often, and should perform so well, I determined to set myself to the task of finding out if there was any method or technic by which this operation could be attended with fewer untoward results.

In considering the causes for poor results from tonsil operation there might be mentioned:

1. A tendency to hurry on the part of the surgeon.

2. Lack of proper training by many who claim to be specialists.

3. The army of general practitioners and surgeons who think that a tonsillectomy is a minor procedure that any tyro may undertake.

4. Methods employed. It is surprising how many men yield to the subtle temptation of hurrying through a tonsillectomy as if their professional reputation were at stake if the usual time was exceeded. The abdominal surgeon on entering the abdomen and finding a badly adhering appendix does not feel abashed if he is thrice the usual time removing it, for the pathology found demands different oper-

ative approach from the ordinary non-adhesive type. Likewise the tonsil. Some are badly adherent to the pillars from long continued inflammation. In this type hurry frequently means permanent injury to surrounding structures.

Recently a mother brought a beautiful little girl five years of age to see me at the State Clinic, stating that the child complained about a drawing sensation in her throat, and that she had talked through her nose ever since an operation on her tonsils one year ago. She added that a very skillful surgeon performed the operation, as he was only three minutes taking out both tonsils. One glance at the little sufferer's throat revealed the sade fact that in those three eventful minutes the operator—like Hercules—had cleaned the Augean stables in quick order, snatching out tonsils root and branch, for there was neither anterior or posterior pillar on either side and half of the soft palate, including the uvula—all were gone. I thought, "what if that were my own little girl!" While the above is an extreme case, and does not often happen, I have seen hundreds of these little throats in a less degree maimed and deformed for all time.

At the State T. B. Clinic we do routine ear, nose and throat examinations on all members of exposed families. We therefore see children from all over the city, affording a fine opportunity to judge of the post-operative results from practically all the large clinics. The number of poor cosmetic and physiological results have appalled me.

The net result of the great majority of cases is unquestionably the betterment of the child. We are too familiar with the indirect progeny of diseased tonsils, namely, rheumatism, nephritis, neuritis, arthritis, endocarditis, pericarditis, appendicitis, adenitis, iritis, etc., etc., to underestimate the good accruing from the elimination of this source of infection.

In the past few years focal infections have been brought into such prominence that the tonsil, constituting one of the main citadels of such infections, has acquired a new position of respect. Likewise this change has greatly added to the number of cases referred by the internist to the laryngologist for an opinion. While this has added to the scope of his work, it also involves an equally greater responsibility.

There is every indication that this trend of affairs will continue to lean still more heavily on the laryngologist. Is it not, therefore, incumbent upon him to be able, in a still greater measure, to remove this ofttime offender, the tonsil, with greater credit to the profession and fewer complications to the patient? I know of no finer acid test than for one to calmly and honestly scrutinize his own results.

Among other things it will likely make him more charitable in his judgment of others. This I have attempted to do in my second year, during which unusual opportunities have been afforded to carry out this line of investigation.

The general scheme of my plan was to briefly outline the main points of attainment aimed at by the operation, and then to grade myself on the scale of one hundred. Those items that could be adjudged immediately were noted, the delayed results were then considered two, three and four weeks later. A few of the cases failed to come back, but I was surprised at the number who did give their co-operation. The following are the items on which notations were made:

1. Hemorrhage. Primary and secondary. 2. Complete removal of the tonsil. 3. Injury to pillars, uvula, palate and pharyngeal muscles. 4. Preservation of normal anatomic relations of pillars, uvula, palate. 5. Time of operation. 6. Need of assistance. 7. Ease of operating. 8. Interference with anesthetists. 9. Degree of reaction.

Although the operation for removal of the tonsil has been familiar to medical men almost from the day of Hippocrates, it has only been widely advocated and employed during the past twenty-five or thirty years. It was Pynchon who first championed the cause of tonsillectomy as the rational pocedure to eliminate the tonsil with all the attending evils. His pioneer utterances have been justified by the trend of events since.

The profession at large having gone on record years ago as to the soundness of this position has since been more concerned with the methods to accomplish this end. Medical literature has been replete with reports of commendable efforts to devise the best technic for tonsillectomy. An indirect result of these efforts has been to focus more attention on the anatomy and physiology of the tonsil and the surrounding structures.

Of the various methods devised, the profession at large has adopted but few. Those most widely employed are: the Snare method, the Sluder guillotine, the Beck,—a modification of the Sluder,—dissection with knives and scissors, and La Force. Still others combine the principle of two or more of the above.

Any method should, I think, grade fairly high, under the various headings under consideration to justify its continued employment.

In carrying out this program of study, two methods were used. Half the operations were performed by the Snare and half by La Force.

In order to procure a fair opportunity of comparing methods I employed in one series, the La Force on the right side, and Snare on the left. In several instances, where two from the same family were operated on at the same time, one was done by the La Force, the other the Snare. The parent then instructed to note carefully the general complaints of the child regarding sore throat, general reaction, and loss of time from school or play.

In order to widen the scope of this investigation, I procured the privilege from Doctors Skillern and Coates, of examining all tonsil cases operated on at Medico Chirurgical Hospital. This courtesy afforded an unusual opportunity of studying post-operative results, as well as method employed. These clinics are held daily and average from thirty to fifty cases a week. Three days a week the Snare method was used, and the other three, the La Force. These operations were all performed by doctors taking the course in otolaryngology at the University.

As the children were discharged from the hospital the following day, they were instructed to report to the State Clinic. At this time I took the child's name, carefully inspected the throat, noting as many points above mentioned as possible, and instructed parent or guardian to note the number of days the child complained of throat, and refrained from play, and report same to me. Thus each child was inspected on four successive weeks and results carefully noted and graded.

This, in brief, has been the method adopted of studying post-operative results of my own, as well as other cases.

May I add here that this study was begun with no thought of reporting it? I am doing so now by request. My one purpose was to find out for myself, where mistakes were being made, and endeavor to improve my own technic, to the end that I could render better service to my patients. Let us now consider the points in detail.

1. *Hemorrhage. A. Primary, B. Secondary.* The comparison under this heading was a striking one. Nine out of ten La Forces are practically bloodless, necessitating no time or attention whatever to the bleeding. In fact, the operator might wear white kid gloves without fear of soiling them, so free is the operative field from blood. With the Snare, a part of the routine procedure is applying gauze and pressure to control hemorrhage, and start the suction apparatus to clear field of blood, and to prevent the patient from aspirating it into the trachea. As to secondary hemorrhage, none of the cases under consideration by either method required any attention, hence I shall not discuss this phase of the subject.

2. *Complete removal of tonsil.* Potentially the Snare should grade some higher than the La Force as, admittedly, there are a few cases, probably five out of a hundred, that are not adaptable to the La Force method. Actually, however, from cases studied more parts of tonsils were left in by the Snare, than La Force. This is likely due to the bloody field in which the surgeon is forced to operate, which together with bruised and torn pillars,—so often present in dissection,—is sufficient cause to make it questionable, at times, whether all tonsilar tissue has been removed.

3. *Injury to pillars, uvula, and intrapharyngeal aponeurosis.* Here again the comparison left no room for doubt. If an operator has attained any degree of dexterity and skill with the La Force, it is seldom that he will injure the anterior pillar. The posterior pillar hardly comes into consideration as the La Force technic works and moves anterior to post pillar, so there is no possibility of injuring it. What a contrast, this, to the record of the Snare, which seems to have special predilection for post pillars. In fact, this is one of the most frequent accidents with the Snare. It is difficult to always know just the position of the tonsil in relation to the pillars, and all too frequently a prong of the instrument in grasping the tonsil reaches back into the posterior pillar, thus causing the Snare to commit more or less serious damage to it.

As to the soft palate, here again the La Force is rather working away from than toward it, hence its injury is not to be considered. We shall see later the record of the Snare in this respect.

The damage to intrapharyngeal aponeurosis is not so frequently considered as the other more easily seen structures. Its importance is, however, none the less because of its retiring position. This aponeurosis is one of the fascial planes of the neck, descending from the base of the skull, and bares the important responsibility of lining the denuded tonsillar fossa, provided it does not meet the same fate from the Snare that often befalls the post pillar. "The reason why this aponeurosis is not injured by the La Force, becomes apparent when it is remembered that by pressing the rim of the arc of the fenestrum against the pillar, the intrapharyngeal facia and pillars are made taut, allowing only the thin, loose aroelar tissue, which attaches the tonsil to the facia, to engage in the fenestrum, while closing the blade." Thus is preserved this important structure. While the technic of the Snare renders injury to it most liable.

There are other instruments, as, for example, the Beck, which carry out this same principle of delivering the tonsil under a two axis tension through a fenestrum, that are giving splendid results.

4. *Preservation of normal anatomic relations of pillars, uvula and palate.* In all tonsil operations the goal striven for, is the complete eradication of tonsil with the least possible disturbance to the normal relations, the physiology and anatomy of pillars, uvula, soft palate and pharyngeal aponeurosis. It is only sound logic to assume that the technic which injures them least, preserves them most. This my experience has proven is better accomplished by the La Force technic.

5. *Time of operation.* I have been informed by the anesthetists and operating-room force that there is a marked difference in the time factor in favor of the La Force. Miss Kenny, head anesthetist of Medico Chi (who is here tonight and will speak for herself), states that given the same number of cases for an afternoon, one operator using the Snare, the other La Force, with the latter technic the cases will be completed one-third sooner and with half the work and worry to the operating-room force. Almost the same testimony came from Miss Thompson, chief anesthetist at the Polyclinic Hospital. She is also here tonight. The views of these highly trained technicians, while they may be from a different angle than that of a doctor, are nevertheless most valuable. They are constantly in this work, and have an unusual vantage position to observe comparisons and make constructive criticisms. Those of us who move in beaten paths often get into ruts so deep that we become narrow.

It is far from my intent to make a plea for hurrying this operation. The prime essential is thorough removal of tonsil, with least possible damage to surrounding structures. This accomplished, then only is it proper to look into measures toward expediting the work, and thereby lessening time the patient is under anesthetic. Actual results give the La Force technic a decided advantage in both these respects.

6. *Need of assistance.* The usual duties of an assistant are eliminated with the La Force, namely: holding down tongue, handing operator tonsil seizing forceps, separators, scissors, dissectors, knife, Snare; aspirating blood from operative field and throat, applying sponge to tonsillar fossa to control hemorrhage, and in general playing the role of good man Friday. He has a real job from first to last. The one instrument La Force, in the hand of the operator does the work nicely, smoothly, and completely, with no need of an assistant. If one be present, his moral support is about the only help he had an opportunity to offer.

7. *Ease of operating.* There was a question about incorporating this, it being somewhat foreign to the subject, and, too, it is the

patient's and not the doctor's interest with which we are now concerned. However, may I add in passing that the La Force operator has only about forty seconds real work in connection with each tonsil, the rest of the three minutes being consumed with mere waiting for the hemostatic action to take place.

8. *Interference with anesthetists.* My attention was called to this point by the anesthetists themselves, and for this reason I have asked two nurses who are specialists in this department in two of our large hospitals to be present tonight.

Of the two dangers, anesthesia or tonsillectomy, I believe most will agree that the former is more to be feared from the standpoint of fatality, and anything which renders the anesthetic safer and better administered, is worthy of serious consideration.

It is common practice with the Snare technic, for the anesthetist to get the patient deeply under, and then the operator works as fast as he can to get all possible accomplished before patient comes out and begins to gag and swallow. At this point the operation is suspended and the anesthetist again puts the patient under, but with increasing difficulty, as the blood running down the throat tends to cause strangling and coughing. Thus the patient is swung from the "Scylla" of deep narcosis, to the "Charybdis" of light—each having its attending dangers.

The sine qua non of a good anesthetic is even administration, holding patient steadily in the surgical stage. This can be accomplished only when the anesthetist is undisturbed in the almost constant drop by drop administration of ether. With the La Force technic, the tonsil is removed in about twenty seconds, thereby causing no real interference with anesthetist, since the anesthetic can be carried on during the three minutes the instrument remains on for hemostasis, just as well as if nothing were being done. Asoon as one side is completed, the operator can proceed to the other at once, as there is no hemorrhage and the anesthetic has been going smoothly along with no interruption whatever.

We all have witnessed the mutual embarrassment to operator and anesthetist, when on completion of the first tonsil with the Snare, the patient, struggling and coming out of the anesthetic and the nurse endeavoring to give more ether, while the doctor,—in a "catch as catch can" fashion,—copes with the hemorrhage. Surely a method that obviates all this confusion, is not without merit. The serenity with which the La Force technic moves along, and its adaptability to the anesthetic, stands out in striking contrast.

9. *Degree of reaction.* If any one wonders what reaction means in connection with a tonsillectomy, I respectfully invite him to have

his own removed. There is a "kick" not unlike the reputed effect of prohibition "white lightning." After about ten days of marked discomfort and depressed feeling, there steals over one the convincing conclusion that a tonsillectomy, though involving but a small and insignificant area of the human anatomy, and removed in a few seconds of time, might well have as a befitting epitaph "multum in parvum."

Children as a rule do not have the marked reaction experienced by adults. However, many suffer considerably from shock and are ill for a week.

We have made an earnest endeavor to obtain all information possible under this heading. The throat of each patient was carefully inspected the day following operation, noting the edema of uvula and soft palate, and the amount of reaction manifested in connection with pillars and mucous membrane of throat. The parent then instructed to note carefully length of time child refrained from play. The almost unvarying reports in favor of the La Force led me to resort to another expedient. In a series of cases the right tonsil was removed with the La Force, the left with Snare. By this procedure I was able to check the first observations. The usual report was, "Doctor, my child has not complained much of the right side, but the left has given him a lot of pain." Inspection of that throat usually corroborated the parent's statement. If any one doubts the superiority of La Force to the Snare technic in regard to immediate and delayed reaction, both local and general, my experience persuades me he needs only to try the same experiment, to come to similar conclusions.

There is a very definite connection between injured pillars and post-operative pain and reaction. In almost every instance, where pillar was cut, the surrounding tissue looked angry, red and edematous, and the patient complained of sore throat, painful deglutition and ear ache. This is the type that manifests reaction lasting a week. When one considers the high percentage of injured pillars with the Snare, there is little wonder about the increased reaction in connection with this method.

Post-operative results in the one hundred and fifty cases show the following:

	75 Cases. Snare.	75 Cases. La Force.
Parts Injured		
Soft palate injured	2 or 2¾ per cent	0
Part of tonsil remaining	12 or 16 per cent	8 or 12 per cent
Anterior pillar injured	19 or 25⅓ per cent	15 or 20 per cent
Posterior pillar injured	23 or 30¾ per cent	0
Anterior & post. p. injured	13 or 17⅓ per cent	0
Either ant. or post. pillar injured	52 or 69⅓ per cent	19 or 25⅓ per cent

CONCLUSIONS.

1. That painstaking care and the realization that a well performed tonsillectomy requires a finesse in technic and a thorough knowledge of the anatomy and physiology of these parts, mean much in attaining ideal results.

2. That good results may be obtained from any of the standard methods, but much harder to accomplish with some than others. From my personal experience with the two methods and observation of results obtained by others, I believe the La Force method offers the following advantages:

1. The ease with which the operation is performed. The instrument is automatic and rarely needs adjustment.

2. The almost total absence of hemorrhage greatly facilitates the work by dispensing with all apparatus to clear the field of blood.

3. The lessened amount of trauma to uvula, palate and pharyngeal muscles hastens recovery and diminishes post-operative pain.

4. The lessened amount of bleeding not only conserves the vitality of the robust, but makes for the anemic, and those of lowered vitality the technic of choice.

5. The interference with the anesthetist is negligible, therefore insuring better and safer administration of ether.

6. The impossibility of injuring the posterior pillar and but seldom the anterior, offers the protection that these important structures deserve.

7. The lack of any need for assistance, since the one instrument takes the place of the knife, scissors, tonsil seizing forceps, separator and snare.

8. The diminished amount of trauma makes septic infection much less liable.

9. Lessened amount of secondary hemorrhage as well as primary gives added protection to the patient.

All these make for the comfort and safety of the patient and not only lightens the burden of the surgeon, but after it is finished makes him feel conscious of a task well done.

425 W. Clinch Street.

TWO CASES OF DESCENDING RETRO-ESOPHAGEAL ABSCESS WITH PHLEGMON OF THE NECK AND THREATENING MEDASTINITIS. EXTERNAL OPERATION THROUGH THE VASCULAR ROUTE. PROPHYLACTIC COLLAR MEDIASTINOTOMY. RECOVERY.*

DR. OTTO GLOGAU, New York.

A short time ago, I described before this Section the typical external operation for the abscesses descending from the upper air passages, and the base of the tongue. This method was worked out by myself at the clinic of Prof. Hajek of Vienna, and a detailed report was published in the "Festschrift" to Prof. Hajek's sixtieth anniversary, edited by Urban and Schwarzenberg, November, 1921. and in the July issue of THE LARYNGOSCOPE. The characteristic feature of this procedure is its combination with so-called prophylactic mediastinotomy.

In the two cases which I am demonstrating tonight the typical operation combined with propylactic mediastinotomy proved to be a life-saving procedure.

Case I. Ch. T., 11 months of age, was referred to me on February 2, 1922, by Dr. Charles F. Fisher of Brooklyn.

Anamnesis: The child was born in the U. S. A., while the parents were born in Russia. Both claim to have always been in excellent health. The child is their second one. It is breast fed, and got its first teeth at 6½ months. The present sickness was the first one the child suffered from. About three weeks ago the baby started to cry all night. The mother gave it castor oil and soap and water enema without avail. The next day a physician was called, who found a temperature of 104 and rapid pulse. He also noticed a swelling on the left side of the neck. The doctor suspected peri-tonsillitis and prescribed a mouth wash and internal medicine. As the child's condition grew worse, an ear specialist was called, who opened both drum membranes. A Roentgen picture was taken, but proved to be negative. The child's condition grew constantly worse. A baby specialist was then consulted, who thought an abscess was forming somewhere, but could not locate it. Meanwhile, the child started to choke, especially at night, and would not take its bottle any more, and if it was forced to do so, would vomit immediately. Another baby specialist was consulted, who claimed the stomach was out of order and prescribed a special diet. The baby grew weaker and

*Presented before the Section of Laryngology, April 26, 1922.

weaker, its breathing became more and more obstructed. The temperature showed a daily range from around 99 to 104. During the last few days the child had chills. Dr. Charles F. Fisher, who saw the child in the morning, suspected a deep abscess in the neck and referred the patient to me.

Status present: The baby is well developed, very pale, and apparently severely ill; it is gasping for air and is slightly cyanotic. When given the bottle, it vomits immediately. Temperature 104, pulse 160.

Local examination reveals no apparent pathological change within the throat, with exception of a slight redness at the base of the tongue, in the region of the vallecula. Digital examination reveals a fluctuating swelling on the posterior wall of the esophagus, starting at the level of the arytenoid cartilages and apparently reaching far downward. On the outside there is a dense infiltration noticeable on the left side, at the anterior margin of the sternocleido-mastoideus muscle, starting from the mandibular angle and reaching down to the larynx. This swelling is slightly discolored and is very sensitive to pressure. There is special sensitiveness to pressure present at the jugular fossa. Heart and lungs are apparently normal.

Diagnosis: Descending retro-esophageal abscess with phlegmon of the neck and threatening mediastinitis. Immediate operation is urged upon.

Operation: Performed at Lane Sanitarium, February 2, 1922, 1:30 p. m. Dr. Levengood assistant, Dr. Lane anesthetist. Superficial ether-narcosis is given.

The incision is made alongside the anterior margin of the sternocleido-mastoideus muscle, from the mandibular angle to the jugular fossa. Ligation of the superficial vessels. Blunt dissection is made alongside the anterior margin of the muscle, to the depth of the vascular sheath, whose anterior margin is located, without opening the sheath proper. At the lower aspect of the wound the omohyoideus muscle is severed, and following the inner margin of the vascular sheath downward, the anterior mediastinum is exposed. It is found to be normal and is sealed with iodoform gauze tampon. The thyroid gland is then pushed forward and towards the median line, without, however, injuring its capsule. By lifting the thyroid, the posterior mediastinum is exposed, and as it is also found in a heatlhy condition, it is sealed by iodoform gauze tampon. Having thus protected both the anterior and posterior mediastinum (prophylactic mediastinotomy of Marschik), the abscess cavity is searched for at the upper part of the wound. Here, too, the inner margin of the vascular sheath is located. But the tissues are very hard and indurated and it is impossible to continue working towards the depth by

means of blunt dissection. It looked rather daring and desperate to use a knife in the neighborhood of the carotid artery. But the preceding pharyngoscopic examination pointed the way. At the level of the cricoid cartilage the indurated mass of tissue was incised right medially to the anterior margin of the vascular sheath, about one millimeter from the carotid artery, while the larynx was grasped with the left hand and pulled outward. When the incision had been carried about one centimeter further into the depth, there gushed forward under high pressure about five ounces of creamy, foul-smelling pus. Starting from this point, the indurate mass of tissue was then opened further upward and downward by means of the finger. Digital examination of the abscess cavity showed it to be about 2½ centimeters in width and 8 cm. in length. The vertebral column could be clearly felt beneath its fascia, but no roughness pointing to bone affection could be noticed. Two cigarette drains were introduced into the abscess cavity and the wound was left open. Wet dressing was applied. Immediately after the operation the child's condition showed a remarkable change. The same evening it sat up in bed, breathing normally and asked for the bottle of milk, which it emptied cravingly and without difficulty. The temperature dropped within a few hours and the pulse improved with it. The night after the operation the child slept quietly and restfully. The outside dressing was changed every day. On the fourth day the mediastinal tampons were removed and on the fifth day the two cigarette drains, as there was no more discharge at all present. With the removal of the drains, immediately a slight irritative cough stopped, which was due to the pressure of the drain towards the larynx. On the sixth day the child was dismissed from the sanitarium as cured. After one more week the wound had entirely healed by secondary intention.

Case II. S. H., 30 years old, referred by Dr. Mark I. Schoenberg, April 11, 1922.

Anamnesis: Twelve days ago the patient caught a cold and immediately noticed a swelling on the left side of the neck. This swelling, however, disappeared, but came back four days later. Since that time the patient has felt a choking sensation, has pain in swallowing, and experiences shooting pains toward the head, back and arms. He cannot open the mouth very well and is gasping for air.

Present State: Patient has a subicteric discoloration and is evidently very sick. There is no apparent inflammation present at the tonsils, base of the tongue, or pharynx. Laryngoscopic examination reveals slight edema of the larynx entrance. There is noticeable at the level of *the posterior laryngeal wall, at the left side, a forward*

bulging of the esophageal mucous membrane, which is highly inflamed. There is severe pressure pain alongside of the anterior margin of the left sterno-cleido-mastoideus muscle, at the level of the cricoid cartilage. At the right side the same pain is elicited, but only on deeper pressure. The patient holds his head stiff and inclined to the left side. There is a diffuse infiltration in front of the left sterno-cleido-mastoideus muscle from the mandibular angle to the larynx and a slight swelling in front of the right muscle. Swallowing is extremely difficult. Severe tenderness to pressure is present in the jugular fossa. The patient is slightly cyanotic.

Diagnosis: Descending retroesophageal abscess with phlegmon of the neck and threatening mediastinitis. Immediate operation is advised. The patient went home, however, and returned only late in the afternoon.

Operation: At the Community Hospital at 8 p. m. Doctor Hoiland and Doctor Grove assisting. Anesthetist, De. Hraba. Operation began at 8 p. m., closed at 9 p. m.

Under superficial ether anesthesia, an incision was made alongside the anterior margin of the sterno-cleido-mastoid muscle, from the mandibular angle to the jugular fossa. By blunt dissection, especially with the finger, at the lower margin of the wound, the anterior mediastinum was opened and sealed with iodoform gauze tampons. The thyroid gland was then pushed forward and the posterior mediastinum exposed and sealed in the same way. At the level of the cricoid cartilage a solid mass of indurated tissue was found in front of the vascular sheath, together with enlarged and degenerated glands. One gland, of the size of a hazelnut, was located at the division of the common carotid artery. First by blunt and then by sharp dissection, it was worked towards the depth, and in front of the carotid artery, without opening the vascular sheath, the retro-esophageal tissue was reached by deep incision. About six ounces of foul, yellowish, creamy pus were evacuated. Digital exploration showed a large cavity between the fascia of the vertebral column and the fascia of the esophagus, reaching downward about five centimeters and encroaching upon the other side The wound was left open. Wet dressing was applied.

Due to the bad breathing of the patient I was at any moment ready to perform tracheotomy. The anesthetist remarked, that the moment the pus evacuated, the patient's color immediately changed to normal, and his breathing, which during the operation became very bad, improved instantaneously. The narcosis was a very light one and the patient soon after the operation cried out, "Oh, I feel so much better." The next day he smoked his cigarettes and ate

three hearty meals. He did not complain any more of pains. The outside dressing was changed every day and kept wet. The mediastinal gauze tampons were removed on the fourth day and the cigarette drains on the sixth day, to be replaced by a small strip of plain gauze. On the eighth day following the operation, the entire wound, which had been left open, was closed with the exception of a small central area, through which the above mentioned small drain was introduced into the cavity. In order to close the wound, the margins of the skin were first somewhat undermined and partly sutures, partly adhesive strips, were used. On the tenth day the patient was dismissed from the hospital as cured.

Epicrisis: An eleven months' old baby with a swelling on the neck and difficulty in swallowing and breathing, combined with septic temperature, chills and characteristic pressure pains alongside of the muscle and in the jugular fossa, was for three weeks treated by different physicians and specialists, without the condition being diagnosed. These symptoms pointed to a threatening mediastinitis, due to the descending of the retro-esophageal abscess, which was detected by pharyngoscopic examination. The original cause of these dangerous descending abscesses in babies is usually a submucous abscess in the vallecula, but it may alo start in any other part of the upper air tract without being recognizable by inspection. The symptoms in the second case are similar to those in the first, but here we had besides pressure pains and swelling at the other side of the neck. The abscess cavity in this case had already crossed the middle line and was encroaching upon the vascular sheath of the other side. With the exception of a cold in the patient's history, no etiologic factor was demonstrable. In both cases we had to deal with a solid mass of indurated tissue around the vascular sheath. Only the preceding thorough pharyngo-laryngoscopic examination, through which the level of the suspected pus cavity was ascertained, pointed the way and induced the operator to cut daringly through the indurated mass in front of the carotid artery, in order to evacuate the pus. The sealing of the as yet apparently healthy anterior and posterior mediastinum, prevented the pus during the operation and afterwards from encroaching upon this important interstice between the vital organs, thereby warding off such dangerous complications as suppurative mediastinitis, pericarditis, pleuritis, lung abscess, and general septicemia. The typical external drainage of the descending abscesses, by route of the vascular sheath, combined with sealing of the mediastinum, proved to be a truly life-saving operation in these two cases, as it has proven to be in the previously reported ones.

64 E. 91st Street.

THE IOWA PITCH RANGE AUDIOMETER AND ITS USES.

DR. C. E. SEASHORE, Washington, D. C.

This instrument is a means of measuring the acuity of hearing throughout the significant range of pitch in the human ear.

NEED OF SUCH AN INSTRUMENT.

The inadequacy of instruments now in general use for the measuring of tonal hearing in the practice of otology and laryngology is notorious in view of the fact that the determination of acuity should in many instances be one of the first steps in diagnosis and is an essential procedure in the registering of the effect of treatment or progress of deterioration in many forms of ear and throat disease. Even the best tuning-fork test now in use is inaccurate, inadequate, and time-wasting. The absence of proper instruments is not the fault of the otologist, but is due to the delayed progress in physics and psycho-physics from which such instruments should come.

But in addition to otology, there are many other types of situation in which the need of acuity measurements is pressing. The scientific investigation of hearing can not proceed far without accurate means of measuring acuity. The psychology and the physiology of hearing have been much delayed by want of an adequate instrument of this sort, not only for the study of the laws of sensitivity in the human ear, but also as a basic measure of acuity where hearing is a tool in other investigations.

Civil service and the personnel service of the army and navy present a great need, as many occupations in these fields require an ear sensitive to sound of specific pitch or a wide range of pitch for safety and efficiency. The tests used for such selection at the present time are extremely inadequate. This was strikingly illustrated during the war in that measures used for the selecting of radio-telegraphers and listeners for the submarine destroyer were so primitive as to be of very little value and probably were the cause of great loss of life and property.

The same is true of many civil occupations in industry where there is demand for a sensitive ear in the interest of efficiency and safety.

If, in the interest of preventive medicine, a simple, portable, and reliable instrument were available for use in the schools and indus-

tries, many inceptive cases of ear disease might be discovered early and brought to timely treatment.

One element of musical talent is a sensitive ear; therefore the measurement of tonal hearing is important in the valuation and direction of musical talent.

In all these types of situation the fundamental need is the same; *i. e.*, there is need of an instrument which shall measure accurately and readily the sensitiveness of the ear throughout the significant tonal range in a manner somewhat analogous to the determination of perimetry in vision.

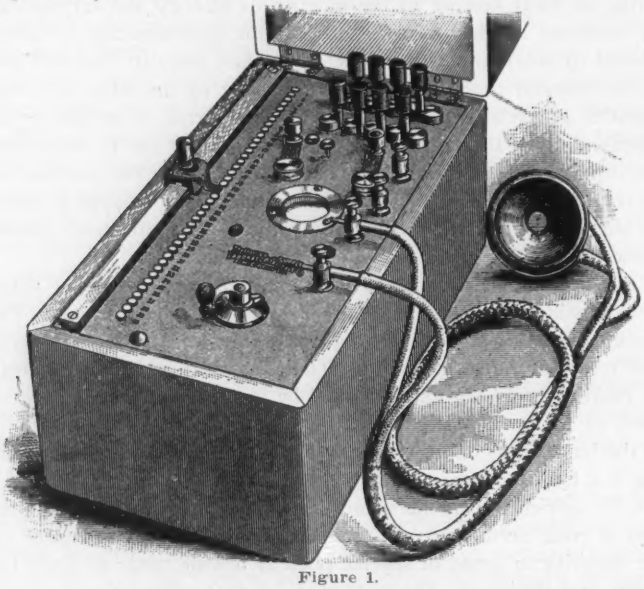


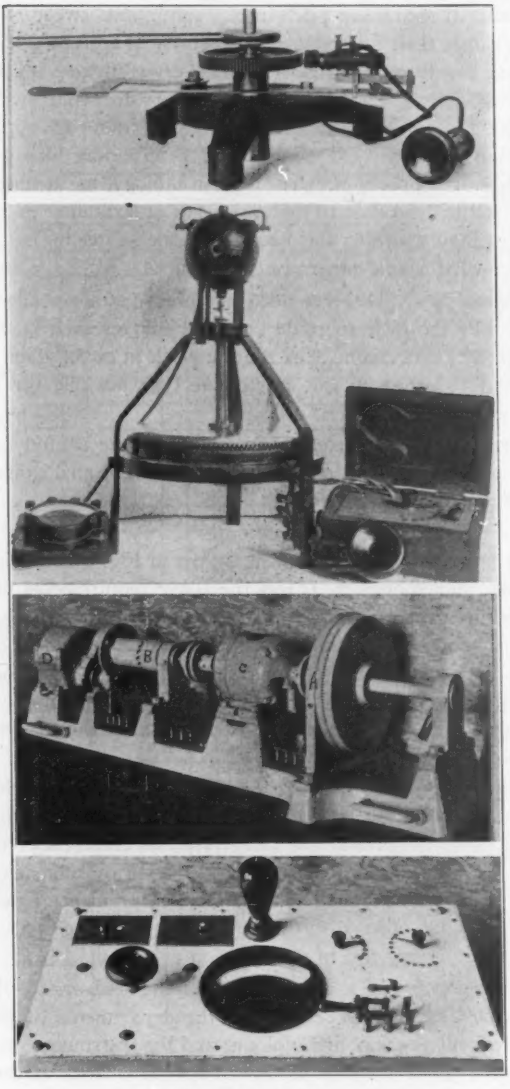
Figure 1.

CHARACTERISTICS OF A GOOD AUDIOMETER.

1. *Tonal range.* It should make possible measurement of acuity at each and every pitch in a continuous series throughout the significant range of pitch.

2. *Intensity of sound.* The sound stimulus should be under ready control for variation and measurement throughout the significant range of intensity and should be recordable in convenient units, either absolute or relative.

3. *Purity of tone.* In order to eliminate accessory or harmonic tones, it is necessary to deal with a relatively pure tone like the tone of a tuning-fork with a resonator.



Figures 2, 3, 4, 5.

4. *Continuity of pitch.* It should provide for surveying of the entire gamut of significant pitch in one continuous sweep at a given intensity, rather than for a sweep of intensity at a given pitch. This is essential for three reasons: (1) The ear fatigues quickly for tones of high pitch; therefore, it is necessary to avoid dwelling on a given pitch. (2) This method of cross section as opposed to cross section of intensity is essential for determining tone gaps and tone islands with precision. And (3) in otology, as in many other forms of testing, the time of the physician or examiner is valuable, and this method shortens the necessary time of testing to a small fraction of what would otherwise be required.

5. *Adaptability.* There is need of three distinct grades of instrument: (1) the highest grade available for research laboratories and clinics; (2) one adapted for routine work in otology and similar service; and (3) the simplest serviceable type possible for popular use in schools and industries.

6. *Norms.* For each type of instrument there should be available age norms and norms of variability somewhat analogous to our norms for perimetry in vision.

HISTORICAL.

In 1897 I designed the instrument shown in Fig. 1 and coined for it the name "audiometer."* It met the above requirements in so far as the measurement of hearing at a single pitch is concerned; and, so far as I know, no instrument has been designed since then to meet that particular purpose any better. It has proved of great value in the psychological laboratory, but has not found its way into otology for the reason that it was restricted to the measurement of a noise or a single tone.

The committee on Acoustic Problems, of which I was chairman in the National Research Council during the war, recognized the great need of an instrument for three types of emergency: (1) for the selection of suitable listeners in the detection of submarines and operatives in radiotelegraphy; (2) for the measurement of the effect of shell-shock and other disorders upon the ear; and (3) for a more adequate hearing test in examination of recruits.

The problem was taken up seriously in the University of Iowa through a most hearty co-operation of the departments of psychology, electrical engineering, and otology; and the instrument on which I am to report is the outcome of this co-operative work of the three departments. Dr. C. C. Bunch was employed, first, as a research

*"An Audiometer." Univ. of Iowa Stud. in Psychol., II., 1897, 158-163. (Manufactured by C. H. Stoelting Co., Chicago, Ill.)

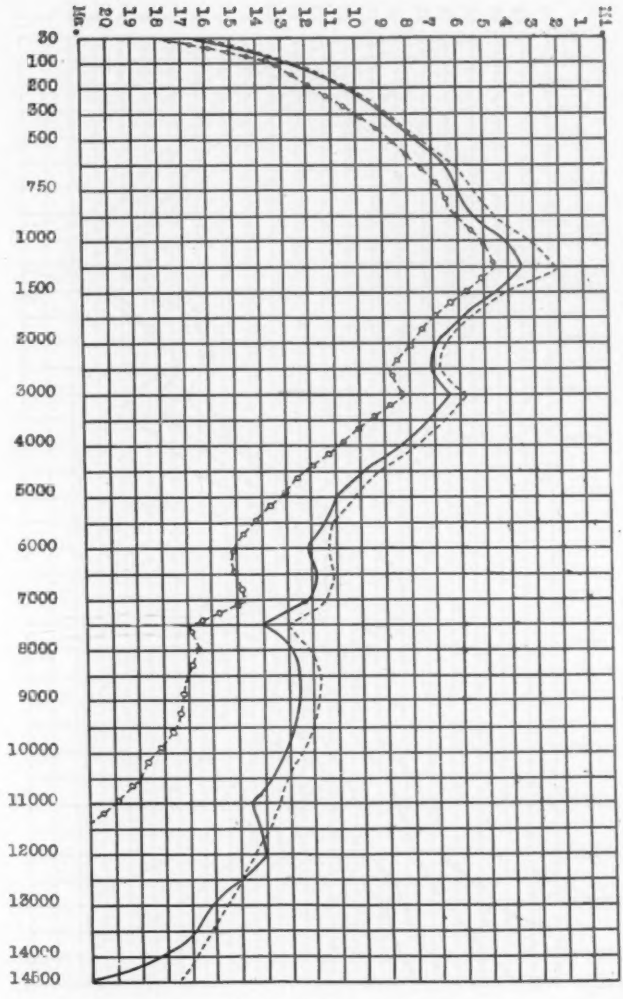


Fig. 6. Age norms: dotted line, children (6-15); solid line, young adults (17-41); dash circle line, aged(42-73).

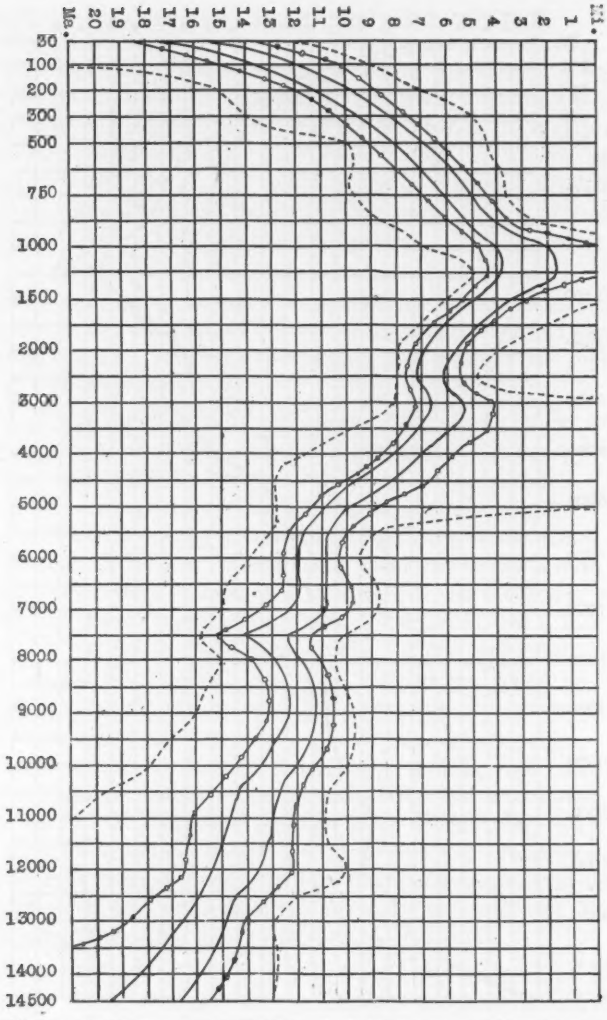


Fig. 7. Zonal norms for children (6-15): highest zone best 10 per cent; next lower, best 20 per cent; middle zone, middle 40 per cent; next lower next lower zone, next lower 20 per cent; lowest zone, lowest 10 per cent.

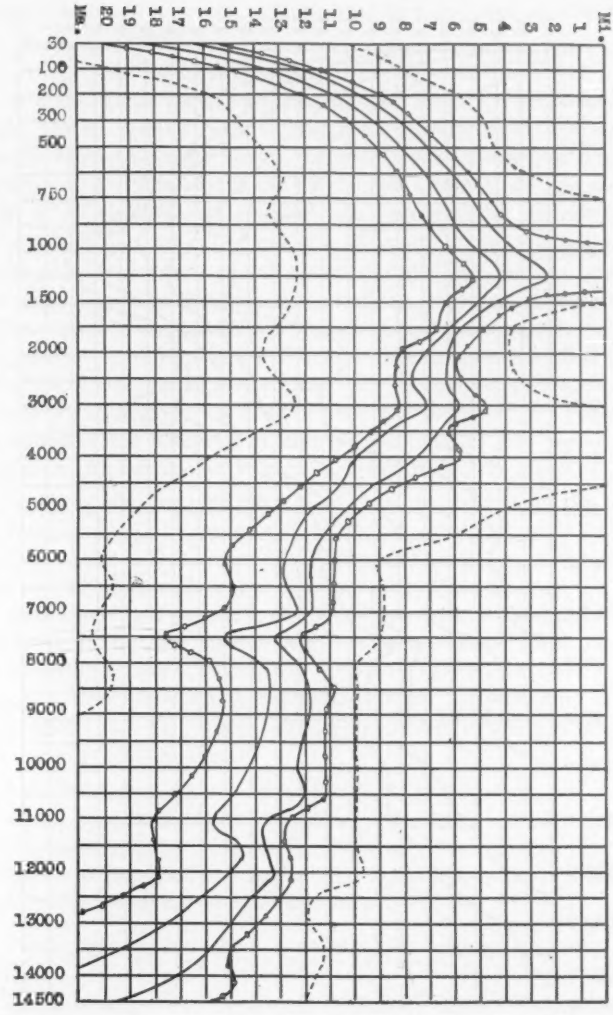


Fig. 9. Zonal norms for aged (42-73): highest zone, best 10 per cent; next lower, best 20 per cent; middle zone, middle 40 per cent; next lower zone, next lower 20 per cent; lowest zone, lowest 10 per cent. zone, next lower 20 per cent; lowest zone, lowest 10 per cent.

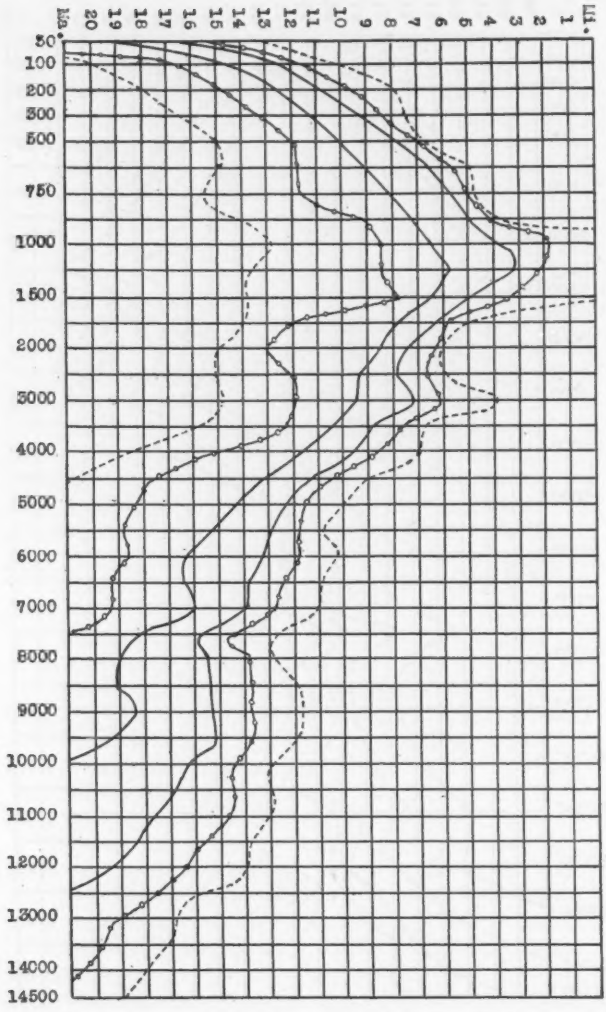


Fig. 8. Zonal norms for young adults (17-41): highest zone, best 10 per cent; next lower, best 20 per cent; middle zone, middle 40 per cent;

assistant on this problem, and later, as specialist in this work within the department of otology; the instrument should, therefore, be placed largely to his credit. The norms here recorded are the work of Dr. B. F. Zuehl.*

DESCRIPTION OF THE INSTRUMENT.

In the effort to construct an audiometer which, in so far as possible, should comply with the requirements laid down above, we finally decided upon the use of the well known principle in physics, which may be illustrated in the very simple form of our first model, Fig. 2. Two telephone receivers are connected on opposite ends of a telephone cord. The one that is mounted on the tripod is stripped of its rubber cap and casing in order that the two poles of its magnet may be close up to a revolving cog-wheel. When each of two cogs of the wheel are opposite a pole, a magnetic arc is formed just as if we laid a nail across the two poles. As the wheel revolves, a gap is gradually formed and, as the next cogs approach, a new arc is formed. For each of these arcs there will be a pulsation of sound in the telephone receiver. The pitch of this sound will, therefore, depend upon the speed of revolution of the wheel.

In this model we used the stroboscopic disk shown in the background of Fig. 2 to measure the speed of revolution and, through that, the pitch. This device can be rigged up in a very simple manner in connection with a small phonograph. The quality of the tone is dependent upon the shape of the cogs or teeth. The intensity or loudness of the tone may be varied in several ways. The method employed in this first model, Fig. 2, was to vary the distance of the magnet from the wheel by means of a lever. The intensity of the tone varies in a logarithmic ratio with the size of the gap between the magnets and the wheel.

I shall not here go into detail in regard to the scores and scores of snags we struck in the progressive development of the instrument, some of them of a subtle and unexpected nature. For example, it is impossible to get an iron casting of uniform magnetic quality for a toothed wheel of this sort.

*Publications on this subject up to date have appeared as follows: Seashore, Carl E., "The Iowa Pitch Range Audiometer." The Journal-Lancet, October 15, 1919; Dean, L. W., and Bunch, C. C., "The Use of the Pitch Range Audiometer in Otology." The Laryngoscope, St. Louis, August, 1919; Seashore, Carl E., "The Psychology of Musical Talent." Boston: Silver, Burdett & Company, 1919, pp. 87-94; Dean, L. W., and Bunch, C. C., "Results Obtained from One Year's Use of the Audiometer in the Otological Clinic." Trans. of the Am. Otol. Soc., 1920; Dean, L. W., "Studies in Otology—Using the Pitch Range Audiometer." Am. Laryn., Rhinol., and Otol. Soc., Atlantic City, June 3, 1921; Bunch, C. C., "Measurement of Acuity of Hearing Throughout the Tonal Range," Univ. of Iowa, Stud. in Psychol., VIII, 1922; Zuehl, B. F., "Measurement of Auditory Acuity with the Pitch Range Audiometer," Univ. of Iowa Stud. in Psychol., VIII, 1922.

Fig. 3 shows the second model. Here, in place of having merely one bipolar magnet, we have two symmetrical toothed wheels of 150 teeth each, the lower having its teeth wound as a magnet. This device was found necessary for the purpose of eliminating unevenness in the magnetic qualities of the wheel. The top wheel is rotated by a belt from a variable speed motor, not shown in the figure. Instead of the more primitive method of stroboscopic disk for registering speed, we have here in the globe at the top of the instrument a tachometer which measures speed in terms of the deflection in a galvanometer shown at the left; and, instead of varying the intensity by change in the distance of the magnet, as in the first model, we introduced a graded series of resistance thrown as a shunt across the circuit through the receiver. These are contained in the chest at the left. This instrument proved very serviceable, but its range ran only from 30 to 3,200 d. v.

I shall pass over a series of experimental models and present the one we call model 4, which is shown in two parts, Figs. 4 and 5, respectively.

Fig. 4, section A, is a large generator, which has one stationary and one rotating disk, each having 150 teeth. This generator has a primary coil (not shown), energized with a battery potential of 8 volts, and outside of this is a secondary coil in the circuit of the telephone receiver, the whole being so adjusted that, as the wheel revolves, each passing of opposite teeth produces one sound wave in the receiver. This generator produces sounds from 200 d. v. up to approximately 14,500 d. v. Section B is a small generator, constructed on the same principle, for the production of the low tones, from 10 d. v. to 300 d. v. Instead of having 150 teeth, it has only 15. B is a series wound motor connected with the two generators through leather couplings. The motor is operated on a 110 volt circuit either DC or AC. The speed of the motor is controlled by the rheostat knob at the left of the control board, Fig. 5. D is the generator part of the tachometer which measures the speed of revolution by means of the galvanometer in the center of the control board, Fig. 5. The tachometer scales on the galvanometer, one for the small generator and one for the large, are graduated in terms of vibrations per second, expressing the pitch. The intensity of the sound is controlled by the resistance series at the right on the control board, giving a series of 22 steps from maximum to minimum, in which minimum gives approximately the faintest sound that any one can hear in the most sensitive region, and the maximum gives a sound so strong that it is on the verge of becoming painful to the

normal ear in the most sensitive region. These differences of intensity vary by regular increments of 250 per cent from step to step of the resistance introduced.

The tone is produced in an ordinary telephone receiver and the subject signals when he hears the tone by pressing a key which lights up the signal light above the tachometer on the control board, the understanding being that the observer hears the tone whenever that light is on and ceases to hear it when it goes out. The generator part, Fig. 4, is mounted in a padded box in a distant closet and only the control board is present in the experiment room.

To repeat, the *pitch* of the tone is determined by the speed of revolution of the toothed wheels which in turn is controlled by the rheostat, and is registered directly in terms of double vibrations per second on the tachometer. The *quality* of the tone is determined by the shape of the teeth, their shape being such that the magnetic flux will assume approximately a sine curve, which is the condition for a pure tone. The *intensity* of the tone is varied by a shunt system in the form of a graded series of resistances.

Typical record blanks with norms are shown in Figs. 6, 7, and 8 for children (ages 6-15), young adults (ages 16-41), and aged people (age above 42), respectively. Fig. 9 shows median norms for the three age groups analyzed in Figs. 6, 7, and 8. These norms are given for Model 5, which is the one now in use in the psychological laboratory, as described by Dr. Zuehl, *op cit.*

This is all very formidable, but, in actual operation, the procedure is very simple. With the chart for children, Fig. 6, before us, let us follow the procedure of testing, for example, a child twelve years of age.

The child is seated with the telephone receiver to one ear. The operator, having given the instructions, "Press the button as soon as you hear a tone, listen carefully as this tone rises, and release the key the moment you cease to hear any tone," sets the intensity control at maximum and, starting the speed control at zero, speeds up the motor in one continuous sweep, so that a range of pitch is produced from the lowest audible tone to about 14,500. This is done in one gradual sweep. He then puts a check mark on the *Ma.* line indicating where tone came in and where it went out at the upper end, noting carefully the presence of gaps. He then repeats the operation in slowing down the motor, going from a high to a low pitch. Then he sets the intensity control at 20 and makes a similar sweep through all the pitches at that level, up and down. In a similar manner, successively weaker intensities are taken in

order until that intensity is found at which sound can not be heard at any pitch, or he has reached the minimum sound, *Mi*. For convenience the region of the low generator and the region of the high generator may, however, be surveyed separately.

By plotting a curve from these check marks on the chart, he will produce the curve of hearing for that ear. He is then in position to evaluate that with reference to "normal hearing" for persons at that age by reference to the zones in the chart. The highest zone in each of these norm charts embraces the best 10 per cent; the next zone the next best 20 per cent, the next zone; *i. e.*, between the solid line curves, the middle 40 per cent; the next zone below, the next lower 20 per cent; and the lowest zone the lowest 10 per cent. The hearing of the observer is then plotted in the same manner in the same chart but in different color. Any hearing curve so charted may be evaluated at a glance by its relative shape and position within the zone of the norm. These zonal boundaries, it must be remembered, are smoothed curves representing averages. The record for a single individual is likely to be more irregular.

HOW THIS INSTRUMENT MEETS THE REQUIREMENTS.

Let us now consider to what extent this audiometer possesses the characteristics of a good audiometer. For this purpose we may check our achievement in terms of the requirements laid down at the outset, namely, the manner in which this audiometer meets the demand for tonal range, control of intensity, the production of a pure tone, the continuity of pitch sweep, adaptability, and norms.

1. *Tonal range.* It produces tones from the lowest audible up to 14,500 d. v. But, as shown in the charts, the tones in the upper region are gradually less and less audible. Therefore the instrument does not measure the upper limit of hearing. This we must still measure by some such means as the Galton whistle. It does, however, cover the range of pitch which is most significant for music and speech as well as for clinical diagnosis, and, perhaps, more than is necessary for purely clinical routine or ordinary functional testing.

2. *Intensity of sound.* The scale of intensity here used is relative. The conditions of construction may, however, be standardized so as to make them constant, and the actual output of sound may be measured at any time that it may be desirable to interpret the scale in absolute units of energy. This will be necessary only for scientific purposes. All other purposes can be served just as well

with the relative scale. The intensity scale covers an adequate range for both normal and pathological cases.

3. *Purity of tone.* The models now in use produce a serviceably pure tone. If further refinement should be wanted, it is simply a question of more accurate determination of the necessary shape of the teeth for the production of the perfect sine curve in the magnetic flux. In the higher region, accessory tones from the running of the machine are present, but these are not readily confused with the true tone.

4. *Continuity of pitch.* This audiometer is the only instrument now available which makes it possible to sweep quickly through the entire pitch range for a given intensity. As has been pointed out, this feature is a fundamental requirement in an audiometer, because it eliminates fatigue, as the sound does not remain constant for any considerable time at any high pitch; it reveals tone gaps and islands with precision; and it reduces the time of testing to a small fraction of the time required for testing with tuning-forks.

5. *Adaptability.* In its latest model, the present instrument is expensive, as it could not be put on the market for less than $1,000. However, it serves the purpose for which it was built and, with certain minor modifications in the way of simplifying construction, it will meet the needs of the scientific laboratory and clinic. The principle on which it is constructed is, however, such that instruments of any degree of complexity desired may be built, from a $5 outfit to a $5,000 outfit, depending upon the two factors of the cost of production and the thoroughness of measurement. It would therefore seem desirable to put three models of the instrument on the market, namely, (1) the present model, type 5, with minor modifications for the most exacting work, with an upper limit of 15,000 d. v.; (2) the same simplified in construction and adapted for routine work in otology and similar measurements with an upper limit of 7,000 d. v.; and (3) a still smaller and easily portable model with an upper limit of 3,500 d. v., for use in more general elementary tests of hearing.

6. *Norms.* One advantage of having these three grades of instruments built on the same principle is that norms established for each would have common elements and would lead to a common nomenclature.

LIMITATIONS OF THIS REPORT.

I have thus attempted to present in high relief the outstanding features as to the need of a pitch range audiometer, the characteristics demanded, the description of our Iowa instrument, and a com-

parison of its characteristics with the required characteristics of an audiometer. I have intentionally omitted details in description and directions for construction, numerous details of qualification in statement, and all reference to other instruments and methods extant. Indeed, this report may be regarded as a brief for one type of instrument presented with definite understanding that other principles of measurement may well be worth considering.

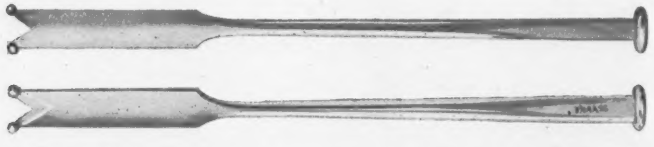
The University of Iowa has spent large sums of money and the best efforts of the co-operating men have been given without stint. The instrument will be placed on the market without patent or royalty to any one in the hope that it may serve some of the needs enumerated, or at least prove a stimulus to the invention and standardization of better instruments.

1701 Massachusetts Avenue.

A NEW SEPTAL CHISEL.

Dr. Sidney L. Olsho, Philadelphia.

The chisel illustrated herewith is a modification of the Hajek septal chisel and can be used in the Hajek handle. The modification is that each of the lateral points of the "V" shaped cutting edge is



capped by a ball. The balls do not tear the nasal mucosa as do the sharp edges of the original. This chisel is of particular advantage near the floor, as it provides the broadest possible laterally-protected cutting surface in the narrowest possible space.

A STUDY OF THE TONAL RANGES IN LESIONS OF THE ACOUSTIC NERVE AND ITS END ORGAN.*

Dr. L. W. Dean, Iowa City, Iowa.
Dr. C. C. Bunch, Iowa City, Iowa.

The study which I am about to report represents a very large amount of careful, conscientious work, especially on the part of Mr. Bunch, who made all the measurements.

This work has been very interesting and somewhat instructive to us. My hope is that it will be of some interest to you.

In making this study, three things were determined: first, the upper limit for the audition of tones; second, the lower limit; third, the variations in the range between these two limits.

Plate 1. Galton whistle, monochord, Koenig cylinders.

The upper limit was determined by means of the Galton whistle, the Strychen monochord, and the Koenig cylinders. The lower limit was determined by means of forks.

The lantern picture shows the Koenig cylinders, the monochord, and the whistles used.

The variations in the range between the upper and lower limits were determined by means of the audiometer and the Bezold series of tuning forks.

For the benefit of those who are not interested in the audiometer readings we have made in each case a quantitative determination of audition for the 50 d. v. fork, the C, C^1, C^2, C^3, C^4, and C^5 forks.

Plate 2. Normal Audiometer Curve.

As the upper limit of the audiometer is 7,070 d. v. that part of the tonal range between 7,070 d. v. and its upper limit we have not studied. Satisfactory tuning forks cannot be constructed for very high notes. We know of no way of determining quantitatively the audition of notes in this part of the range.

The records with the audiometer are easily indicated by means of a graph shown in Fig. 2. The pitch of the tones is indicated at the bottom and the strength of the tone by the height of the record on the graph, no tones at all being normally heard at zero. The curve shown on the graph is the field of hearing for a normal ear.

It appears from the general shape of the curve that the ear is most sensitive to tones in the region below 300 d. v. and 3,000 d. v.

*Read before the Otological Section of the New York Academy of Medicine, February 10, 1922.

It has been shown by many careful experimenters that the ear is most sensitive to tones corresponding in frequency with those of the human voice and these tones are known to lie in this range. It is quite evident from the shape of the normal curve that it takes less current to arouse a sensation of hearing for tones between 300 d. v. and 3,000 d. v. than in any other part of the hearing range. The telephone receiver used is adapted especially for notes in this part of the tonal range and explains in part the height of the curve.

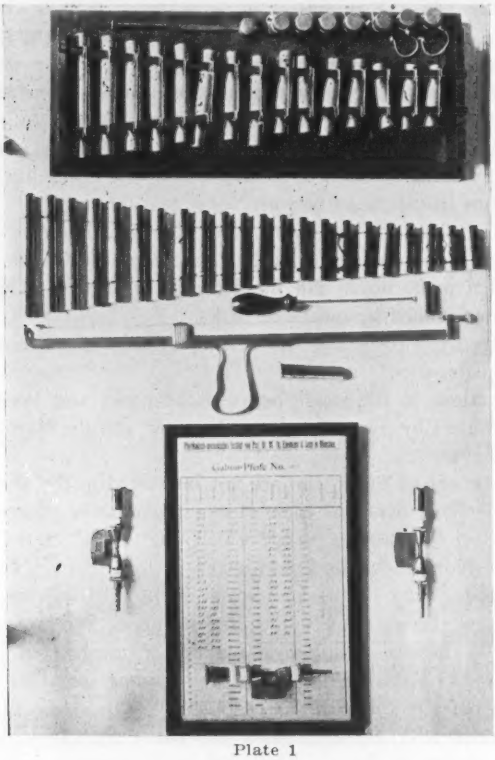
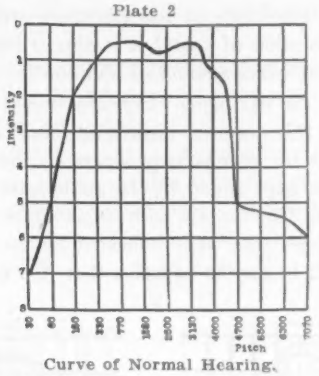


Plate 1

In the curves of cases studied that we are going to show, the curve was secured by testing the audition of the ear examined for every note from 30 d. v. to 7,070 d. v. The curve thus secured compared with the normal curve which is stamped on every chart gives an approximate idea of the relative amount of hearing for each note.

Plate 2



Curve of Normal Hearing.

Plate 3

UPPER LIMIT OF HEARING.

Physics			Otology		
Winkelmann	24000	v.d.	Phillips	48000	d.v.
Barton	40000	"	Ballenger	22097	"
Spinney	32000	"	Bezold	41000	"
Catchpool	28000	"	Kerrison	41000	"
Hegener	20000	"	Hovell	42000	"
Miller	20000 to 30000	"	Barr	20000	"
Schwent	20000 to 27361	"	Dench	about 32500	"
Schulze	20000	"			
Struycken	22000	"			

MISCELLANEOUS.

Scripture	25000 to 50000	d.v.	Savart	24000	d.v.
Sauveur	6000	"	Despretz	36864	"
Chladni	8192	"	Blake	40000 to 60000	"
Wollaston	24000	"	Gildemeister	25000	"

OUR RESULTS.

	Limit	Calibrated to
Galton Whistle		
No. 1029	21000 d.v.	29000 d.v.
No. 1813	23000 d.v.	25000 d.v.
Koenig Cylinders		
No. 1	49152 v.s.	65536 v.s.
No. 2	43960 v.s.	65536 v.s.
Monochord A.C.	19000 v.d.	25000 v.d.
B.C.	20000 v.d.	

When, for instance, the curve at 1,000 d. v. is only half as high as normal, it does not mean that hearing for that note is one-half normal but only that hearing for the note is markedly decreased. We are not justified in assuming that the curves represent the exact relative audition for the note that is being tested. The fractions which express quantitatively audition for various notes, when this is determined with the Bezold forks, are likewise very inexact. As the intensity of sound varies with the square of the distance, with

the square of the amplitude of the vibration, and is influenced by the rapidity of vibration of sound it is almost impossible to determine in any way the exact amount of audition for any given note.

If the curve of the ear being examined should show a tone gap in the tonal range this does not mean that there is an absolute tone gap but means that for sounds as produced by the audiometer there is a tone gap. The gaps found by the audiometer have been tested in the psychological laboratories with organ pipes and other instruments and with these tone gaps indicated by the audiometer have been confirmed. It is easy to conceive that if a note could be pro-

Plate 4

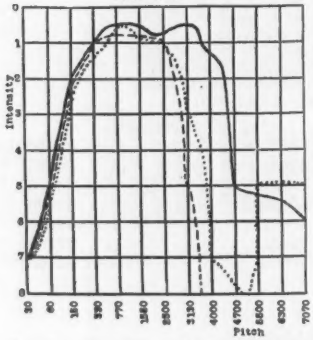
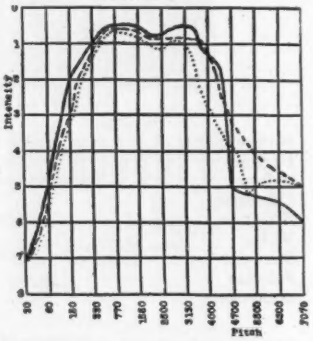


Plate 5



Dr. S. Age 27. Diagnosis: Neuritis of Nervous Cochlearis. Hearing, Right: Whisper, 15 ft. Left: 15 ft. Forks 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 18/18 24/24 48/48 1/120. L 4/4 8/8 12/12 18/18 24/24 48/48 1/60. Upper Limit: Galton R 20000 d.v. L 20000 d.v. Koenig R 43960 vs. L 43960 v.s. Monochord A.C. R 17000 d.v. L 17000 d.v. B.C. R 18000 d.v. L 18000 d.v. Bone Conduction: R —2 sec. L —3 sec. Low Limit: 11 d.v. each.

Mr. C. L. H. Age 35. Diagnosis: Neuritis Acoustica. Post Influenzal. Throat also bad at that time. Voice: R Whisper 15 ft. Spoken 45 ft. L Whisper 15 ft. Spoken 45 ft. Forks 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 3/4 6/8 10/12 24/24 36/36 48/48 60/60. L 3/4 6/8 10/12 24/24 36/36 48/48 60/60. Upper Limit Galton R 19000. L 19000. Koenig R 40960 v.s. L 40960 v.s. Monochord A.C. R 16000. L 16000. B.C. R 18000. L 18000. Bone Conduction: —8 sec. each.

duced of greater intensity than by the audiometer it might be heard when the audiometer would produce no sensation of sound.

In the following charts the normal curve is indicated by a continuous line; curves for the right ear by dashes; and for the left ear by dots.

Plate 3. Shows the upper limit of hearing as noted by various observers.

One of the most important diagnostic points for lesions of the nerve and its end organ is a lowering of the upper limit of hearing by air and bone conduction.

Plate 3 shows the differences in opinions regarding what constitutes the upper limit.

If 48,000 d. v. is the upper limit of hearing and we find that our patient's upper limit is 23,000 d. v. we must answer that there is a lesion of the nerve or end organ.

In no case have we found the upper limit of hearing to exceed 25,000 d. v. We are of the opinion that this should be considered the approximate maximum upper limit. We are inclined to believe that the structure of the cochlea determines this and that no tone much higher than 25,000 d. v. can be heard.

Plate 6

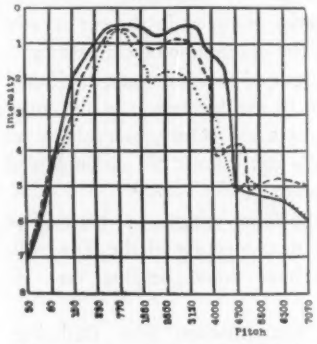
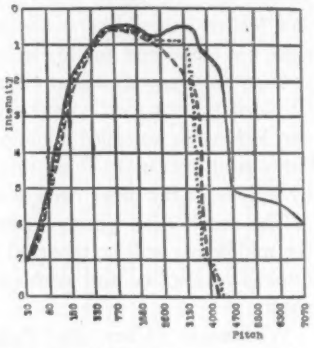


Plate 7



Miss H. A. Age 21. Diagnosis: Congenital syphilis, Gumma of palate. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 24/24 36/36 48/48 60/60. L 4/4 8/8 12/12 24/24 36/36 48/48 60/60. Upper Limit: Galton R 17000. L 17000. Koenig R 27306. L 27306. Monochord: R A.C. 14000. B.C. 18000. L A.C. 14000. B.C. 16000. Bone Conduction: Normal, both ears. Caloric reactions: Normal.

Dr. N. Age 37. Diagnosis: Neuritis Acoustica. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 18/18 24/24 48/48 1/100. L 4/4 8/8 12/12 18/18 24/24 48/48 1/180. Upper Limit: Galton R 18000. L 15000. Koenig R 43960. L 30720. Monochord: A.C. R 13000. L 9000. B.C. R 13000. L 9000. Bone Conduction: R —2 sec. L —4 sec.

The intensity of the note produced has an influence upon the upper limit. With the instrument producing the more intense notes, the upper limit will be higher. Hence, with different Galton whistles different upper limits are found in the same patient.

When a note of more than 25,000 is apparently heard, we are inclined to think that the patient is hearing a noise and not a musical sound. Noises are characterized by their irregularity or suddenness, musical sounds by their comparatively smooth and even flow. Noises are produced by irregular and non-periodic vibrations, while musical sounds are produced by those which are regular and periodic.

There is usually a decrease in the upper limit with advanced age. Koenig, the French physicist and instrument maker, reported his upper limit at 41 years as 23,000 d. v., at 57 years, 20,480 d. v., at 67 years, his upper limit had fallen to 18,432 d. v.

We are of the opinion that the lowering of the upper limit with age is not a physiological process; that it is due to a lesion of nerve or end organ, the result of arterio sclerosis, infections and whatnot. Wittmaack is of the opinion it is a degeneration of the ganglion cells in the cochlea due to arterio sclerosis.

As a result of a routine, exact measurement of the tonal range of our otological cases, we have come to the conclusion that lesions of the acoustic nerve and its end organ are exceedingly common. We feel that these lesions are much more common in the ear service than are nerve and fundus lesions in the ophthalmological service.

Two years ago Emerson (Transactions of the American L. R. and O. Society, 1920) called our attention to the frequency of the inner ear lesions in so-called middle ear diseases. Our observations so far would lead us to think that middle ear lesions not accompanied by lesions of the inner ear are not common.

The result of a year's study of the tonal ranges of diseases of the middle ear will be reported at the next meeting of the American Otological Society and perhaps may have some bearing on this point.

Wittmaack (Uber die Patholog-Anatomischen und Patholog-Physiologischen Grundlagen usw, Archiv für Ohren, Volume 99) is of the opinion that nephritis, lymphactic diseases, lues, all kinds of cachexias, anything changing the alkalinity of the blood, suppurative processes in the middle ear, otosclerosis, hyperplastic otitis media, and the various infections, may cause a lesion within the cochlea.

We are inclined to feel that the frequency of cochlear lesions may be influenced by three factors; first, the complexity of the organ of Corti; second, comparatively speaking, its youth (the organ of Corti is approximately 2,000,000 years younger than the retina. It made its appearance about the time that vertebrates appeared on the land. The retina had been present in fishes approximately 2,000,000 years before), and lastly, the diffusibility of the round window as demonstrated by Wittmaack probably has a decided bearing on this matter.

In lesions of the nerve or end organ, the upper limit is occasionally not cut down, and it is not right to exclude so-called inner ear diseases because there is no marked diminution in the ability to hear the highest notes.

Plate 4 shows the tonal range of a patient with neuritis of the nervous cochlearis right and left. Note that while there is a diminution in the audition for notes from 3,000 to 7,000, in the right ear, the upper limit as determined with the Galton whistle, Koenig cylinders, monochord by air conduction and by bone conduction is lowered but slightly. You will note the diminution in the power to hear the 4,096 d. v. fork and the diminished bone conduction which would make a diagnosis of a lesion of nerve or end organ. All our observations with the Koenig cylinders are reported in single vibrations.

Plate 8

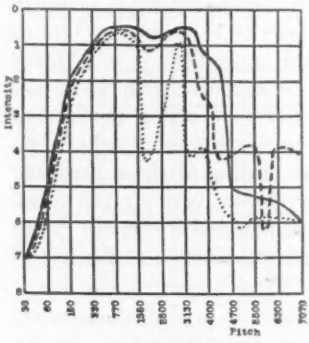
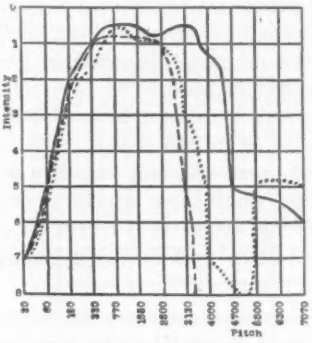


Plate 9



Dr. E. Age 32. Diagnosis: Hyperplastic Otitis Media with Cochlear Degeneration. Voice: R. Wh. 15 ft. Sp. 45 ft. L Wh. 13 ft. Sp. 40 ft. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 18/18 24/24 36/36 48/48 60/60. L 4/4 7/8 15/18 20/24 30/36 40/48 58/60. Upper Limit: Galton R 21000. L 21000. Koenig R 43960. L 43960. Monochord: A.C. R 17000. L 17000. B.C. R 19000. L 19000. Bone Conduction: R —3 sec. L —4 sec.

Dr. S. Age 26. Diagnosis: Neuritis Acoustica. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft. Forks: 50 v.d. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 18/18 24/24 48/48 1/120. L 4/4 8/8 12/12 18/18 24/24 48/48 1/60. Upper Limit: Galton R 20000. L 20000. Koenig R 43960. L 43960. Monochord: A.C. R 17000. L 17000. B.C. R 18000. L 18000. Bone Conduction: R —3 sec. L —2 sec.

Again in inner ear lesions we may have a normal tonal range as measured with the audiometer and with the tuning forks.

Plate 5 shows the tonal range of a case of acoustic neuritis bilateral. Note that the 4,096 d. v. fork is heard normally, and that the tonal range up to 7,000 d. v. for each ear is normal and that hearing for voice and whisper is unimpaired. The upper limit as measured with the Galton whistle and the monochord is decreased, and bone conduction is greatly diminished—8 seconds in each ear. In chronic otorrhea with lesions of the cochlea well marked, we occasionally find that the bone conduction when measured with tuning forks of about 512 d. v. or less, is normal or even increased.

Plate 6 shows the findings in a case of an inner ear lesion due to congenital syphilis. The hearing for the voice and the whisper was apparently normal, the Bezold forks were heard at a normal distance, the tonal range, as measured with the audiometer, for the right ear was practically normal and for the left ear there is a slight depression, bone conduction normal, but the upper limit much decreased when measured with monochord both by air and by bone and with the Galton whistle and the Koenig cylinders.

In making perimetric examinations of the eyes no ophthalmologist would conclude that because the outlines of the visual field were normal or because there was no central scotoma that the nerve or retina was functioning normally. Neither should we as otologists conclude because the upper limit happens to be normal or because the tonal range as measured from 30 d. v. to 4,096 d. v. is found normal, or because the bone condition as measured with the C^1 and C^2 fork is found to be normal that there is no lesion of the acoustic nerve or its end organ. A lesion of nerve fibre or of cells in the end organ will only interfere with the hearing of those particular notes which these structures are concerned in receiving and transmitting, and there is no reason why a minute lesion confined to any part of the cochlea should interfere with the function of the rest of the organ.

Careful examination of the tonal ranges of individuals supposed to have normal hearing furnishes some very interesting results. Some of our very best cases from the research standpoint were discovered by Mr. Bunch in making his laboratory examinations in the Psychological Department. Later in this paper we report one of these cases that was of much interest to us.

The examination of the assistants in the clinic during the last two years has shown that three of the eight have unsuspected lesions of the auditory nerve, or its end organ.

Plate 7 shows the tonal range of one of the assistants in the clinic. Note the diminution in the audition for notes from 3,500 to 7,000 d. v., confirmed by the diminution in the power of hearing the 4,096 fork in each ear. Bone conduction was decreased; the hearing for voice and whisper, however, was normal. Voice and whisper include sounds from 60 d. v. to 3,000 d. v.

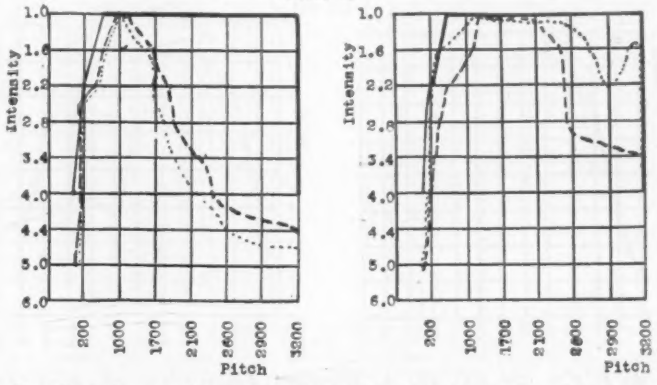
Plate 8 shows the tonal range of another assistant in the clinic. His hearing as determined with the whisper and voice was normal in right, slightly diminished in left; the examination with the audiometer and the tuning forks show marked decrease in the audition of certain notes. These areas of diminished audition are repre-

sented by depressions in the curve. Bone conduction is diminished, right three seconds, left four seconds; upper limit is lowered both by bone and air with the monochord.

Plate 9 represents the findings of a third assistant in the clinic. Note again the decrease in the upper part of the tonal range as measured with the audiometer, confirmed by the diminution of the power to hear the 4,096 d. v. fork. The upper limit was lowered, bone conduction decreased.

Three out of the eight clinical assistants examined in the clinic had these distinct inner ear lesions. This suggests to us the fallacy of depending upon comparative tests in order to determine the patient's powers of hearing. A comparative test is not reliable unless

Plate 10



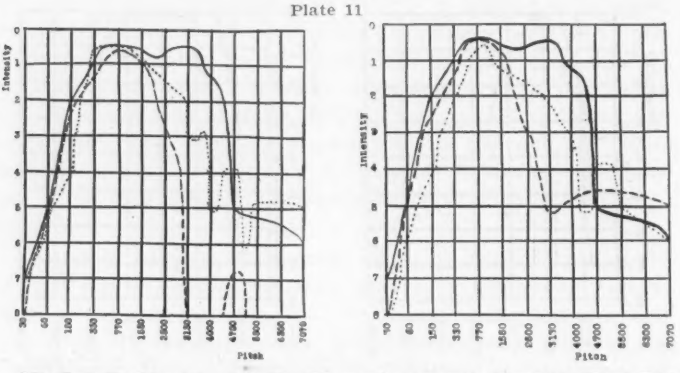
Mrs. E. C. G. Age 32. First Test October 31, 1918. Second Test June 6, 1919. Diagnosis: Acoustic Neuritis, secondary to Chronic Tonsillitis. Tonsils removed November 8, 1918. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft. Fork: c^3 R 45/60 L 45/60. Bone Conduction: R —8 sec. L —10 sec.

we are certain that the hearing of the individual with whom the patient is to be compared is normal. These three assistants had been testing the ears of patients in our otological clinic. If we had depended upon comparative results, these men comparing the patient's hearing with their own, assuming their hearing was normal, we would have had results which would have been untrustworthy. It is not a safe thing to attempt to determine the upper limit of hearing of your patient by comparing his with yours unless you know that your limit is normal. Naturally, if the examiner takes into consideration any known defect of himself the results would be reliable.

Plate 10 shows the tonal range of a patient taken before and after the removal of faucial tonsils. This chart was made with the old

audiometer, which had a different norm from the new one. This patient had an unsuspected defect in the tonal range and was one of the cases that was discovered by Mr. Bunch in carrying out his laboratory class experiments. On questioning her the fact was elicited that she suspected that her sense of hearing for faint or distant sounds was not quite normal. The diagnosis was acoustic neuritis secondary to chronic tonsillitis. Six months after the removal of tonsils the measurement of her tonal range showed that it approached the normal. Notice the marked improvement in the audition of the higher notes in the range as measured with the audiometer. The patient reported that she could hear the noises of crickets and other insects that she had not heard before.

Plate 11



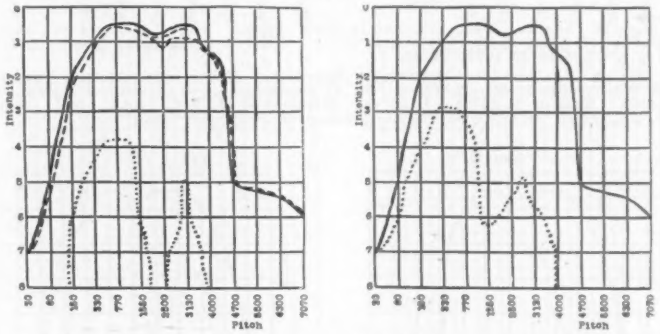
Mr. G. J. D. (Dr. A.) Age 25. Diagnosis: Acoustic Neuritis. First Test January 19, 1921. Voice: Rt. W 10 ft. S 30 ft. Lt. W 15 ft. S 45 ft. Influenza, February, 1919, with paralysis of Rt. side lasting two or three days. Upper Limit: Galton R 17000. L 21000. Koenig R 32768. L 40960. Monochord: A.C. R 15000. L 16000. B.C. R 18000. L 18000.

Second Test June 23, 1921. Tonsils removed, January 22, 1921. Voice: Rt. W 15 ft. S 45 ft. Lt. W 15 ft. S 45 ft. Upper Limit: Galton R 20000. L 22000. Koenig R 40960. L 43960. Monochord: A.C. R 19000. L 19000. B.C. R 20000. L 20000.

Plate 11 shows the measurement of the tonal range of a patient who was in the service of Dr. Albright. A diagnosis of acoustic neuritis was made in January; tonsils were removed in January; six months later the tonal range was again analyzed. Note the disappearance of the tone gap in the right ear and the increase in audition for notes in the upper part of the range. The improvement in the left is not so marked as in the right, which was the poor ear. There was also an increase in the power of hearing whisper and voice in the right ear and the upper limit, which had been lowered, returned to normal.

Plate 12 is another plate showing the influence of the removal of tonsils upon the tonal range in certain cases where the lesion of nerve or end organ or both is secondary to tonsillar infection. This patient came complaining of extreme vertigo; the attacks were becoming more severe; the vertigo was rotary in type; during the attack the patient vomits and falls to the left. This was on September 20, 1920. Note the diminished hearing in the left ear as indicated by the audiometer curve; also the tone gap between 2,000 d. v. and 2,500 d. v.; the 2,048 d. v. and the 4,096 d. v. forks were not heard in the left ear; the upper limit was much lowered. The testing of the vestibular apparatus did not give any definite information. Bone

Plate 12



Dr. H. A. B. Age 36. Diagnosis: Labyrinthitis, Left, secondary to diseased tonsils. Date: September 1, 1920. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 8 in. Sp. 4 ft. Upper Limit: Koenig R 40960. Monochord: R A.C. 14000. B.C. 16000. L A.C. 13000. B.C. 17000. Bone Conduction: Left. —6 sec.

September 8, 1921. Voice: L Wh. 10 in. Sp. 4 ft. Upper Limit: Galton R 17000. L 16000. Koenig R 40960. L 40960. Monochord: R A.C. 13000. B.C. 15000. L A.C. 15000. B.C. 15000. Bone Conduction: Left, —3 sec.

conduction was diminished 6 seconds. Because of the lesions being unilateral and because of the disturbance of the hearing and equilibrium, a diagnosis of labyrinthitis secondary to chronic tonsillitis was made, rather than an acoustic neuritis. The tonsils were removed. One year later the patient was again seen. He reported that his vertigo had disappeared soon after the removal of the tonsils and that the hearing in the left ear had improved. Note the improvement in the tonal range; there was an improvement in the bone conduction and the upper limit remains unchanged as does also the power of hearing the C^4 and the C^5 forks. There was an improvement in the hearing of the C^1, C^2, and C^3 forks.

Plate 13 shows the tonal range of a post influenzal acoustic neuritis. This patient presented himself in February, 1916, complain-

Plate 13

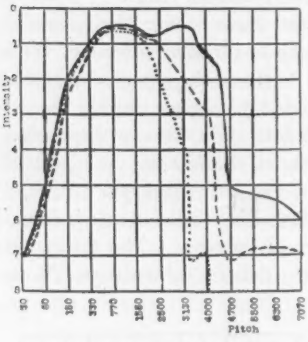
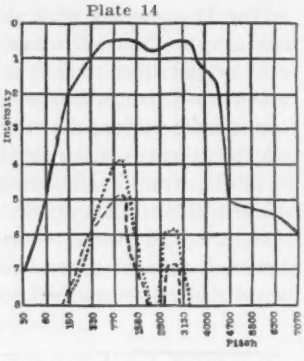


Plate 14



Dr. R. Age 23. Date: October 16, 1920. Rinne each. B.C. —4 sec. each. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 1/1 4/4 4/4 7/8 10/12 15/20 20/40. L 1/1 4/4 4/4 7/8 10/12 15/20 20/40.

Mr. A. P. Age 11. Diagnosis: Hereditary Neuro-labyrinthitis. Voice: R Wh. 0. Sp. 10 ft. L Wh. 0. Sp. 10 ft. Upper Limit: Galton R 16000. L 16000. Koenig R 32768. L 32768. Monochord: R A.C. 14000. B.C. 17000. L A.C. 14000. B.C. 17000. Bone Conduction: —10 sec. each.

Plate 15

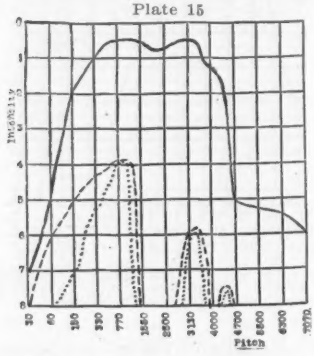
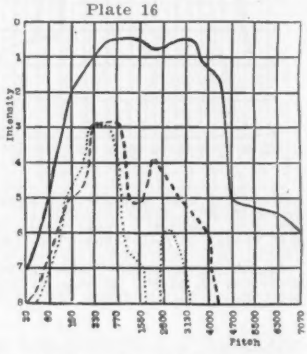


Plate 16

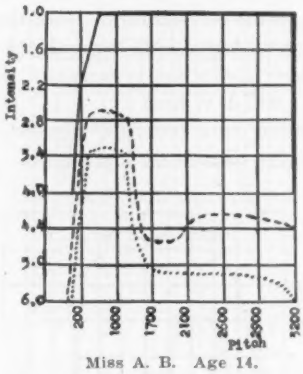


Mr. E. P. Age 16. Diagnosis: Hereditary Neuro-labyrinthitis. Voice: R Whisper close to ear. Sp. 1 ft. L Whisper close to ear. Sp. 1 ft. Upper Limit: Galton R 14000. L 16000. Koenig R 27306. L 30720. Monochord: R A.C. 13000. B.C. 13000. L A.C. 14000. B.C. 14000. Bone Conduction: —10 sec. each.

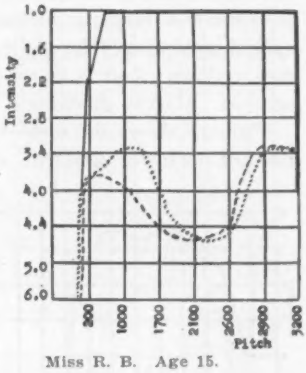
Mr. A. P. Age 8. Diagnosis: Hereditary Neuro-labyrinthitis. Voice: R Wh. 1 ft. Sp. 20 ft. L Wh. 8 in. Sp. 16 ft. Upper Limit: Galton R 15500. L 14500. Koenig R 30720. L 30720. Monochord: R A.C. 9000. B.C. 10000. L A.C. 9000. B.C. 10000. Bone Conduction: R —2 sec. L —3 sec.

ing of diplopia. A diagnosis of neuritis of one or more of the motor ocular nerves plus neuritis acoustica bilateral was made. The examination of the paranasal sinuses was negative. On November 20 the patient was again seen. The ocular trouble had disappeared, the acoustic neuritis persisted. The tonsils were removed with no influence whatsoever upon the tonal range or the hearing.

Plate 17

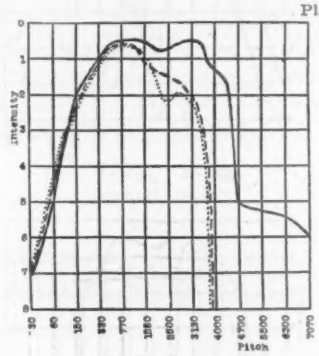


Miss A. B. Age 14.

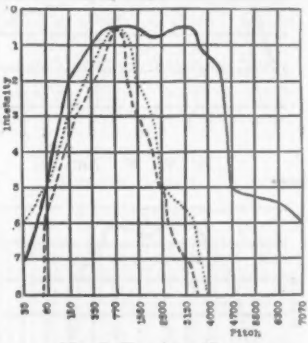


Miss R. B. Age 15.

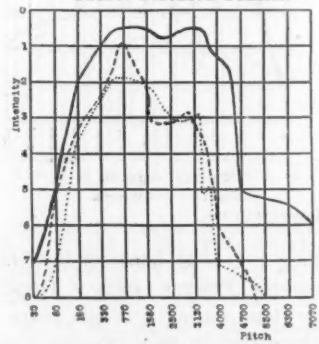
Plate 18



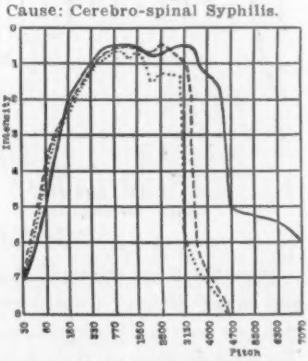
Mr. W. S. Age 26.
Cause: Diseased Tonsils.



Mr. J. T. Age 47.
Cause: Cerebro-spinal Syphilis.



Mrs. M. B. Age 50.
Cause: Cerebro-spinal Syphilis.

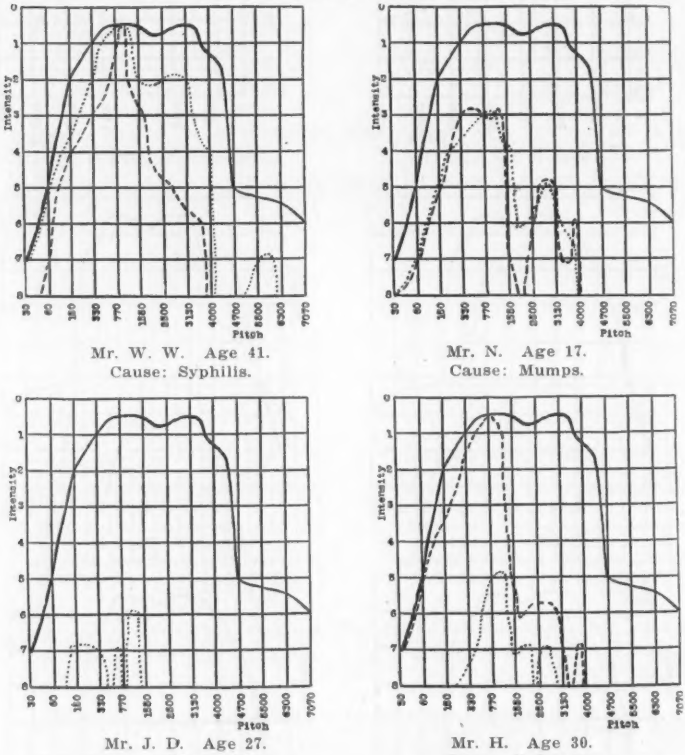


Mr. S. Age 30.
Cause: Diseased Tonsils.
Diagnosis: Acoustic Neuritis.

Plate 14 shows the curve of a boy aged eleven of whose case we have made a diagnosis of hereditary neuro labyrinthitis. Note the typical tonal range; the higher notes as measured with the audiometer cut down; there is a tone gap. Bone conduction is decreased 10 seconds. Marked diminution for the 4,096 d. v. fork.

Plate 15 shows the tonal range, tuning fork tests, the measurement of the upper limit, etc., for a brother of the case just shown.

Plate 19



Mr. W. W. Age 41.
Cause: Syphilis.

Mr. N. Age 17.
Cause: Mumps.

Mr. J. D. Age 27.
Cause: Meningitis.

Mr. H. Age 30.
Cause: Influenza.

Diagnosis: Neuro-Labyrinthitis.

Plate 16 shows the tonal range, tuning fork tests, bone conduction and upper limit of a third member of the Powers family. These children have all been patients in our clinic during previous years. The examination of their histories show that in each instance the diagnosis was neuro labyrinthitis, cause unknown. Supposed foci of infection have been removed; treatment has been instituted with-

Plate 20

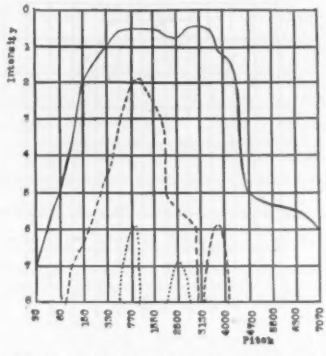
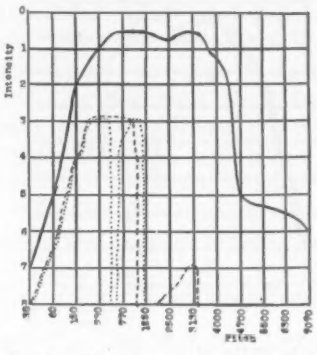


Plate 21



Mr. Wm. E. Age 60. Diagnosis: Leukemic Deafness. Voice: R Wh. 8 ft. Sp. 45 ft. L Wh. 0. Sp. loud voice close to ear. Forks: 50 v.d. c c^1 c^2 c^3 c^4 c^5. R 1/4 2/8 2/16 12/24 10/36 30/48 2/60. L 0 0 0/16 0/24 0 0/48 0. Upper Limit: Galton R 12000. L 10500. Koenig R 27306. L 27306. Monochord: A.C. R 7000. L 7000. B.C. R 14000. L12000.

Mr. S. H. Age 63. Diagnosis: Neuro-Labyrinthitis from Pellagra. Voice: R Wh. 6 in. Sp. 2 ft. L Wh. 6 in. Sp. 6 ft. Upper Limit: Galton R 14000. L 14000. Koenig R 30720. L 30720. Monochord: A.C. R 14000. L 13000. B.C. R 14000. L 15000. This curve suggests the influence of metabolic disturbances on the organ of hearing.

Plate 22

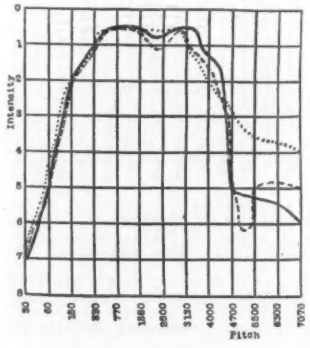
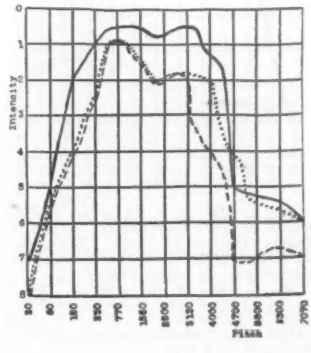


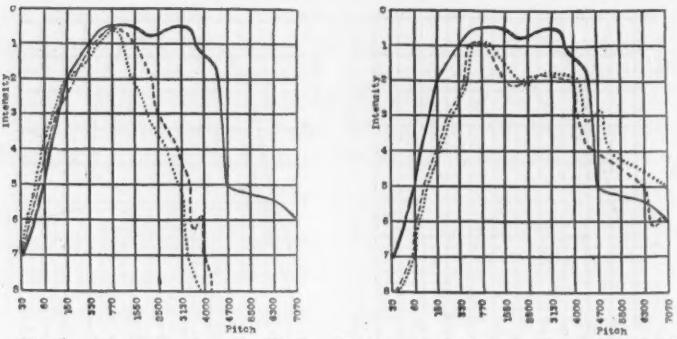
Plate 23



Mr. W. K. Age 25. Date: January 5. 1922. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 24/24 36/36 48/48 60/60. L 4/4 8/8 12/12 24/24 36/36 48/48 60/60. Bone Conduction: R —4 sec. L —3 sec. Upper Limit: Galton R 21500. L 21500. Koenig R 40960. L 40960. Monochord: R A.C. 18000. B.C. 18000. L A.C. 18000. B.C. 18000. Lower Limit: 16 d.v. each.

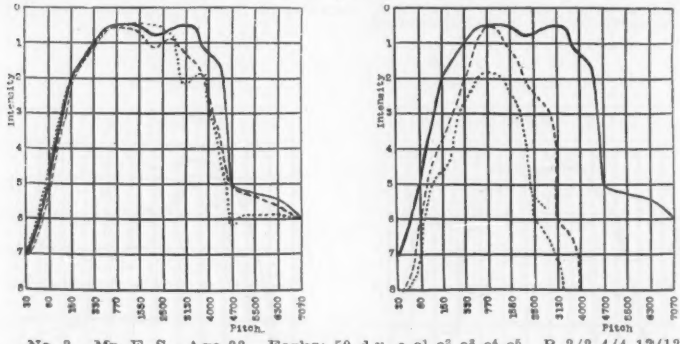
Mr. W. K. Age 25. Date: January 22, 1922. Voice: R Wh. 12 ft. Sp. 45 ft. L Wh. 12 ft. Sp. 45 ft. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 3/4 7/8 10/12 20/24 30/36 44/48 50/60. L 3/4 7/8 10/12 22/24 33/36 44/48 50/60. Bone Conduction: R and L —4 sec. Upper Limit: Galton R 20000. L 20000. Koenig R 43960. L 43960. Monochord: R A.C. 18000. B.C. 18000. L A.C. 18000. B.C. 18000.

Plate 24



No. 1. Mr. T. B. Age 21. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 2/2 8/8 12/12 24/24 32/36 40/48 0/60. L 2/2 8/8 12/12 24/24 32/36 40/48 0/60. Upper Limit: Galton R 21000. L 20000. Koenig R 43960. L 43960. Monochord: R A.C. 17000. B.C. 17000. L A.C. 17000. B.C. 17000. Bone Conduction decreased 3 sec. each ear.

No. 2. Mrs. E. R. Age 26. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 4/4 8/8 12/12 22/24 34/36 44/48 50/60. L 4/4 8/8 12/12 22/24 34/36 44/48 50/60. Upper Limit: Galton R 19000. L 20000. Koenig L 36864. L 40960. Monochord: R A.C. 16000. B.C. 18000. L A.C. 18000. B.C. 18000. Bone Conduction decreased 5 sec. each ear.



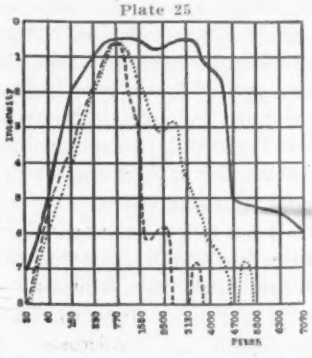
No. 3. Mr. E. S. Age 33. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 2/2 4/4 12/12 24/24 36/36 48/48 60/60. L 2/2 4/4 12/12 24/24 36/36 48/48 60/60. Upper Limit: Galton R 21000. L 22000. Koenig R 43960. L 49152. Monochord: R A.C. 16500. B.C. 16500. L A.C. 17500. B.C. 17500. Bone conduction decreased 6 sec. each ear.

No. 4. Mr. H. B. Age 32. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 2/4 5/8 7/12 14/24 18/36 8/48 0/60. L 2/4 5/8 6/12 14/24 12/36 2/48 0/60. Upper Limit: Galton R 18000. L 18000. Koenig R 36864. L 36864. Monochord: R A.C. 15000. B.C. 15000. L A.C. 14000. B.C. 15000. Bone Conduction Decreased: R 9 sec., L 8 sec.

out any effect on the progress of the deafness. The Wassermann tests of the father and children are negative. In each child the hearing began to fail apparently early in life, the parents noticing it first at the age of two or three years. In each instance the loss of hearing has progressed very slowly. There is no tinnitus. There are in this family seven children,—all boys. Three of the seven are

suffering from neuro labyrinthitis. There is no history of a similar defect affecting any of the ancestors, although the family history which we have secured is very poor. So far as we can ascertain there was no consanguineous marriage. However, in similar instances where there has been a consanguineous marriage we have had great difficulty in eliciting this fact. Our diagnosis is hereditary neuro labyrinthitis. This is the second family of this kind that we have studied. In the other family there were only four children, two girls and two boys. All four were hard of hearing; deafness noticed in each case at the ages of from four to six years. We were only able to examine the two girls. The diagnosis in each case was neuro labyrinthitis. The mother was hard of hearing; she also suffered from neuro labyrinthitis. The mother's father also suffered from deafness.

Plate 25



Mr. H. B. G. Age 53. Diagnosis: Syringomyelia. Forks: 50 d.v. c c^1 c^2 c^3 c^4 c^5. R 3/4 8/8 12/12 20/24 30/36 0/48 0/60. L 3/4 8/8 12/12 24/24 36/36 20/48 10/60. Voice: R Whisper 4 ft. Spoken 36 ft. L Whisper 15 ft. Spoken 45 ft. Upper Limit: Galton R 12000. L 11000. Koenig R 27306. L 27306. Monochord: R A.C. 10000. B.C. 10000. L A.C. 11000. B.C. 11000. Vestibular functions apparently normal. Bone Conduction: R —12 sec. L —10 sec.

Plate 17 shows the curves of the two girls examined, made with the old audiometer. Their upper limits were markedly decreased, bone conduction decreased in one case 5 seconds, in another 8 seconds. In both of these patients the lower forks were heard normally and the ability to hear the higher forks was markedly decreased. This series was studied in 1918. At that time we made a diagnosis of hereditary neuro labyrinthitis.

I have used the terms acoustic neuritis and neuro labyrinthitis, although I cannot differentiate between the two in all cases. The term labyrinthitis has only occasionally been used because Wittmaack (Teitsch. f. Ohren V. 46) has shown that in lesions of the

cochlea the acoustic nerve is soon involved and the term neuro-labyrinthitis is more appropriate.

Suggestive of acoustic neuritis are those cases that are bilateral, onset of deafness slow, no vertigo and the curve does not show gaps or partial gaps. Of neuro labyrinthitis is sudden onset, vertigo and a curve with sharp irregularities indicative of lesions of the organ of Corti. However, there are numerous exceptions.

As a rule it has been those cases with a curve free from irregularities with a dip in the upper part of the range that have improved with the removal of foci of infection, treatment for syphilis, etc.

Cases eleven and twelve were marked exceptions. In no case was the diagnosis of acoustic neuritis or neuro labyrinthitis considered as definite.

Plate 18 shows the tonal ranges as measured with the audiometer for four cases of acoustic neuritis; two cases being due to chronic tonsillitis, two to cerebro spinal syphilis. This type of curve is always suggestive of acoustic neuritis. Note the normal audition for notes in the lower part of the range of the audiometer, and the greatly diminished audition for notes of 3,000 to 7,070. Audition for notes of 500 d. v. to 3,000 d. v., the range of the human voice, is in two of the cases normal so there was no interference with the power of hearing ordinary conversation.

Plate 19 shows the tonal ranges as measured with the audiometer of four cases of neuro labyrinthitis; one due to syphilis; one to mumps; one to meningitis and one to influenza.

Note the presence of tone gaps. These curves with gaps are suggestive of neuro labyrinthitis, and otosclerosis. They are, however, sometimes present in the curves of acoustic neuritis and of lesions of the cochlea secondary to middle ear disease. No curve is characteristic of any disease. The curves, however, frequently suggest the diagnosis.

Plate 20 shows the tonal range of a case of leukemic deafness. These tone gaps are due to hemorrhages or exudates in the cochlea.

Plate 21 is a very interesting curve because it shows the curve of a case of neuro labyrinthitis due to pellagra. It is very interesting, as it illustrates the influence a disease which is supposed to be a pure metabolic disturbance can have upon the cochlear function.

In our service we are making a study of the tonal range of every neurological case which enters the University Hospital. We have in mind examining a large series of cases and then classifying the results and studying them. Up to this moment the work has not been productive of any practical result. Of course, the curve for

cerebro spinal syphilis is very characteristic and is just what one would expect it to be.

We have found so many lesions of nerve or end organ with all kinds of neurological cases that the result of our examinations has had little significance. With lesions of the brain causing increased intra-cranial pressure, involvement of the nervus acusticus has been usual regardless of the location of the lesion.

Plate 22 shows the result of the examination of the tonal range of this case on January 4, 1922. Note that the range as measured with the Bezold forks is without effect; the audiometer shows very slight defects about 5,000 d. v. Bone conduction is decreased four seconds; the upper limit by bone and air as determined with the monochord is slightly cut down. At this point the patient had a papillo-edema of five diopters in the right eye and two in the left.

Following the drainage of the cyst and the injection of air there was a rapid increase in the papillo-edema of the left eye. When this change was noted a second examination of the tonal range was made.

Plate 23 shows the findings at this time. This was 7 days after the first examination. Note the diminution in the audition for all sounds as indicated by the tests with the Bezold forks and the audiometer curve. We have thought that perhaps with increased intracranial pressure we may have a choking of the acustic as well as the optic nerve.

Plate 24 shows the findings in four out of five cases of lethargic enceophalitis that we have investigated. In each of these cases there was evidence of involvement of nerve or end organ. In the fifth case the tonal range, bone conduction and upper limit was apparently normal.

Plate 25 is a case of syringomyelia. The only evidence of syringobulbia is involvement of the nervus acusticus on each side. An interesting thing in connection with this case is that with a lesion in the fourth ventricle we have the C^1 and the C^2 fork heard practically normally by air, while by bone with each fork the conduction is decreased in the right ear twelve seconds; and in the left, ten seconds.

A CORRECTION.

In the reference foot-note No. 1, in my article on Cresatin, which appeared in the March 1923 issue of THE LARYNGOSCOPE, you misprinted *New* for *Non*, in the sentence Cresatin—A new Caustic Cresol, P. 215; just the opposite to which I desire to call attention. The Local use of this remedy is based upon its *non*-caustic action.

M. D. LEDERMAN, M. D.

ITEMS OF INTEREST.

Under this heading THE LARYNGOSCOPE will publish items written by Doctors, to Doctors and for Doctors, with special reference to Laryngologists and Otologists. Communications may be sent to the Editor of News Items, LARYNGOSCOPE. Names will not be published, but must accompany all communications.

LIST OF AMERICAN NATIONAL ORGANIZATIONS WITH DATES AND PLACES OF THEIR NEXT MEETING.

The American Laryngological, Rhinological and Otological Society meets at the Hotel Ambassador May 10, 11, and 12, 1923.
President—Dr. Dunbar Roy, Atlanta, Georgia.
Secretary—Dr. William H. Haskin, New York.

The American Otological Society meets at the Hotel Ambassador, Atlantic City, May 14 and 15, 1923.
President—Dr. George E. Shambaugh, Chicago, Illinois.
Secretary—Dr. Thomas J. Harris, New York.

The American Laryngological Association will meet at the Hotel Ambassador, Atlantic City, May 16, 17 and 18, 1923.
President—Dr. Emil Mayer, New York.
Secretary—Dr. George M. Coates, Philadelphia, Pa.

The Section on Laryngology and Otology of the American Medical Association meets at San Francisco June 25, 26 and 27, 1923.
President—Dr. William B. Chamberlin, Cleveland, Ohio.
Secretary—Dr. Samuel Iglauer, Cincinnati, Ohio.

The American Academy of Ophthalmology and Otolaryngology will meet in Washington, D. C., in October, 1923.
President—Dr. Thomas E. Carmody, Denver, Colo.
Secretary—Dr. Luther C. Peter, Philadelphia, Pa.

The American Bronchoscopic Society will meet at the Hotel Ambassador, May 9, immediately preceding the meetings of the national organizations.

We note with much gratification that there is no overlapping of the meeting dates of the national organizations, as previously existed, and we are confident that with a little sensible prearrangement this may be accomplished each year. We learn from good authority that it is proposed to arrange dates of meetings hereafter in such a manner that one meeting the first one year will change about in ensuing years.

The American Laryngological Association has elected ten new associate members. The president's reception will be held on May 16, and the annual dinner on May 17.

Members of the medical profession are cordially invited to attend the scientific sessions. E. I. L.

The Western Society for the Study of Hay-Fever, Asthma and Allergic Diseases.

First Annual Meeting will take place at the St. Francis Hotel, San Francisco, June 25, 1923. A special program will be presented by the members of the society. All those interested are invited to attend.

A. H. ROWE, Oakland, Calif.